UNIVERSITY OF NAIROBI

COLLEGE OF HUMANITIES AND SOCIAL SCIENCES

FACULTY OF ARTS

DEPARTMENT OF SOCIOLOGY AND SOCIAL WORK

PARTICIPATORY FOREST MANAGEMENT AND DISASTER RISK REDUCTION: THE CASE OF ARABUKO-SAKOKE FOREST IN KENYA

ADINOYI ADAVIZE JULIUS

C50/71729/2014

RESEARCH PROJECT PAPER SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A DEGREE OF MASTER OF ARTS IN ADVANCED DISASTER MANAGEMENT

SEPTEMBER 2015

DECLARATION

Student

This project paper is my original work and has not been presented for the award of a degree in this University or any other Institution of higher learning for examination.

SIGNATURE:……. DATE: ……..

ADINOYI ADAVIZE JULIUS

C50/71729/2014

Supervisor

This project paper has been submitted for examination with my approval as the University Supervisor.

SIGNATURE:……. DATE: ……..

DR. J. K. KIEMO

DEPARTMENT OF SOCIOLOGY & SOCIAL WORK

DEDICATION

This M.A Thesis is dedicated to my loving mother ***Mrs.Victoria Itopa Adinoyi*** and brother ***Dr. Ben Adeiza Adinoyi.***

ACKNOWLEDGEMENTS

My gratitude goes to God for the successful completion of this thesis.

I sincerely appreciate my brother Dr. Ben Adeiza Adinoyi for his relentless financial and moral support to the completion of this degree programme.

I would like to express sincere gratitude and appreciation to my indefatigable supervisor; Dr. J. K. Kiemo, for his valuable academic role and who despite his numerous commitments painstakingly guided this work to meet the required standard.

Special thanks to Prof. Mauri Yambo, Prof. Mburugu and Mr. Alan Korongo for their time and guidance during my stay at the University of Nairobi. Also a lot thanks to the staff of Arabuko-Forest Reserve for their warm support, discussions, suggestions, and close attention. My appreciation goes to the field attendants –Mr. Newton among others, the key informants, and the respondents who participated in this research to ensuring prompt, valid and reliable data collection.

Much thanks and appreciation to the Chairman of Sociology Department, Dr. Robinson, O. Ocharo for his goodwill and concern during the course of my study.

LIST OF ACRONYMS

ACFA	Arabuko Community Forest Association
ASFADA	Arabuko Sokoke Forest Adjacent Dwellers Association
ASFMT	Arabuko Forest Management Team
CBNRM	Community Based Natural Resources Management
CBOs	Community Based Organisations
CFAs	Community Forest Association
CFM	Community Forest Management (same as CBFM, CBNRM)
CO_2	Carbon Dioxide
CSOs	Civil Society Organizations
DRR	Disaster Risk Reduction
EHs	Environmental Hazards
FAD	Forest Adjacent Dwellers
FCPF	Forest Carbon Partnership Fund
FoASF	Friends of Arabuko Sokoke Forest
GCFA	Gede Community Forest Association
GHGs	Greenhouse Gases
GoK	Government of Kenya
KEFRI	Kenya Forest Research Institute
KFS	Kenya Forest Service (formally Forest Department –FD)
KWS	Kenya Wildlife Service
MEWNR	Ministry of Environment, Water and Natural Resources (formally Ministry of Environment and Natural Resources –MENR)
NMK	National Museum of Kenya
PA	Protected Area
PFM	Participatory Forest Management
REDD	Reduction of Emission from Deforestation and Forest Degradation
SCFA	Sokoke Community Forest Association

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Forests in Kenya have experienced various forms of environmental degradation due to the rising potentials of environmental hazards as a result of anthropogenic activities, this informed the emergence of participatory forest management approach between the Kenyan government, civil society organization and the local community formally initiated after 'the consultation phase in year 2000' and subsequently the establishment of the Forest Act of 2005; influencing the joint efforts of Community Forest Associations and the forest management agencies of the Government of Kenya –also in partnership with NGOs and fund agencies to manage the forest in delineated zones as Protected Areas and Community Forest Management areas and Co-management areas in order to ensure mitigations ranging from deforestation, forest fires, environmental degradation, desertification, biodiversity loss, environmental pollution, climate change, ozone depletion and rise of sea level. This effort was further reinforced when Kenya joined the Forest Carbon Partnership Fund in 2010 aimed at the Reduction of Emission from Deforestation and Forest Degradation along with conserving and enhancing forest carbon stock, and sustaining forest management in developing countries.

This project investigates the linkage between disaster risk reduction practices and participatory Forest Management (PFM) in Arabuko-Sokoke Forest (ASF), the study focuses on the PFM practices have impacted hazards and vulnerability reduction, and capacity empowerment mechanisms in the management of ASF areas. And further identify the challenges ranging from policy, institutional and technical issues which have the potential to undermine the mitigative and preventive efforts of catastrophic environmental events. The study was carried out within ASF areas, and adopted a descriptive study design. The unit of analysis was the forest adjacent community and the unit of observation was the individuals. A field study was conducted covering 60 respondents and selected key informants who were purposeful selected.

The findings revealed measures like weak early systems; slightly adequate personnel and resources to respond in an immediate response to disasters. Further implications established that the ASF adjacent community is at risk to deforestation, forest fires, flood, drought, and resource based conflicts which are mostly influenced by anthropogenic activities like legal logging or illegal logging, poaching, agricultural malpractices and other forest malpractices. The PFM approach employed in ASF, have to an average extent incorporated long-term disaster risk reduction measures to reduce vulnerability and hazards of the forest adjacent community, these efforts includes anti-logging policy and practices; adherence to forest zoning of forest resource utilization; community empowerment through educational, financial, and developmental projects; and awareness programs on forest sustainability. It is on this note that this study recommends the need to increase disaster risk reduction incorporated approaches to forest policies and practices through improving early warning systems; conduction and regular review of hazards assessments; and enhancing institutional capacity to reduce forest exploitation, reduce poverty and dependency through expansion of livelihood sources, and community trainings on disaster preparedness – drills/ exercises/ warning system.

CHAPTER ONE: INTRODUCTION

1.0 Background to the Study

After the Kenya independence in 1963, the forest management system was still centralized; this gave rise to forest degradation as communities around the forest illegally gain access to forest products they are officially not allowed to harness. It also increased conflict in the late 1980s between communities needing fuelwood from neighbouring forests and the forest department charged with forest management[1]. After the year 2000's Kenya made a significant progress in the decentralization of forest, which led to the increased Participatory Forest Management (PFM). The PFM approach offers forest zoning opportunities inform of Protected Areas (PA), Co-management Areas, and Community Forest Management (CFM)/Community Based Natural Resource Management (CBNRM) areas[2].

In Kenya, the State institutions that are involved in PFM include Kenya Forest Service (KFS), Kenyan Wildlife Service (KWS), National Museum Kenya (NMK), and Kenya Forest Research Institute (KFRI), while the Community Forest Associations (CFAs) and Community Based Organizations (CBOs) in Arabuko that are engaged in PFM are Arabuko Sokoke Forest Adjacent Dwellers Association (ASFADA); Arabuko Sokoke Forest Management Team (ASFMT); Friends of Arabuko Sokoke Forest (FoASF); and Arabuko Sokoke Forest Guide Association (ASFGA).

The Protected Areas are managed by State Institutions and the level of participation of the community is weak while the community also collaborates with those state institutions for benefits like revenue sharing. The co-management areas involve the State institutions and the community jointly managing the forest as aided by decentralization, and the level of community participation is average or medium.

[1] Ongugo, P.O and J.W. Njuguna. (2004). The Potential Effects of Decentralization Reforms on the Conditions of Kenya's Forest Resources. Paper presented to the Biennial Conference of the International Association for the Study of Common Property (IASCP) on 3-13th August, 2004. Oaxaca, Mexico

[2] Barrow E, Murphree MW. 2001. Community Conservation: From concept to practice. In *African Wildlife and Livelihoods: The promise and performance of community conservation*, Hulme D, Murphree MW (eds.). James Currey: Oxford, UK; 24-37

The last area through which the community is involved in PFM is the Community Forest Management (CFM) or Community Based Natural Resource Management (CBNRM), in this approach, the community has high level of participation through joint partnership with the state institutions.

Globally, about 13 million hectares are lost annually to deforestation[3] while global vegetative area affected by forest fires accounts for about 300 to 400 million hectares annually[4]. In response to the growing disaster risks, the United Nation has since committed itself in Disaster Risk Reduction (DRR) from the of Kyoto protocol in 1994 which informed the establishment of International Strategy for Disaster Reduction (ISDR) in 1999 to the adoption of the Hyogo Framework for Action (2005-2015) (HFA) which in its priority action one and three stressed the prioritization of reducing risk at national and local levels with enhancing administrative capacities at all levels[5]. Thus it is in this view that the foundation of reducing disaster risks culminated, and more recently is the post 2015 DRR framework held in Japan.

Over 36% of rural poor Kenyans live on marginal lands or areas prone vulnerable to environmental degradation[6], also the country is prone to frequent forest fires[7], those habitats are inclusive of the coastal area where ASF is located. Environmental related hazards like drought, flood, and landslide can be triggered to disaster by deforestation through its effects on the level of atmospheric carbon dioxide (CO_2) and climate change[8] –and if allowed to occur could create high vulnerability to secondary hazards like hunger, famine, increased poverty, and climate change through greenhouse gases (GHGs) emission, atmospheric duct contribution, and temperature and precipitation effects. This

[3] FAO, (2006a). Report of the expert consultation on Global Forest Resources Assessment: Towards FRA 2010, 12–16 June 2006, Kotka, Finland. Rome, Italy. (Also available at http://www.fao.org/forestry/11187-1-0.pdf)
[4] UNDP, (2004). Kenyan Natural Disaster Profile: in *Factors contributing to drought severity in Kenya*. p9
[5] Richard, Hilderman. (2010) The Effect of Deforestation on the Climate and Environment – Understanding Climate Change Blog - MOTHER EARTH NEWS. Retrieved March 16, 2015, from www.motherearthnews.com/nature-and-environment/the-effect-of-deforestation-on-the-climate-and-environment.aspx
[6] TNAU, (2014). Major Areas: Disaster Management: Forest Fire. Retrieved March 16, 2015, from www.agritech.tnau.ac.in/agriculture/agri_majorareas_disastermgt_forestfire.html
[7] Sheila Reed, (1997). *Introduction to Hazards*, 3rd edition. InterWorks for DHA Disaster Management Training Programme. In collaboration with the University of Wisconsin-Disaster Management Center and InterWorks.
[8] ISDR, (2008). Report on the Status of Disaster Risk Reduction in the Sub-Saharan Africa Region. p4

is not exclusive to forest fires which have the capability of causing forest degradation with subsequent trigger effects on other disasters[9]. Therefore forest related environmental hazards like deforestation and other forest disturbance[10], if not checked can lead to environmental degradation which in turn leads to disaster in the case of deforestation while forest fire can directly or indirectly lead to disaster. Also the Sub-Sahara Africa region is affected by forest fires, which destroy crops, buildings and infrastructure[11].

Deforestation –the conversion of forested land to non-forested land has the greatest short-term implication to the environment through environmental degradation when compared with other environmental hazards but has a long term implications on disaster. While forest fires have rapid effects to destruction of forest and facilities, it significantly has long term implications on the progression to a secondary disaster. The HFA informed the need for Kenya to have policy regarding disaster; this led to the drafting of the *National Policy for Disaster Management in Kenya in 2009.* The draft tasked line ministries in DRR and encouraged participatory approaches to include non-state actors, and stressed the prioritization of proactive approach over responsive approach of DRR[12]. However much of these are unfulfilled as the policy is yet to be fully implemented[13]. In 2010, Kenya joined the forest Carbon Partnership fund in an effort to reaffirm its duty in forest management in terms of Reduction of Emission from Deforestation and Forest Degradation (REDD+)[14] which in the cause of achieving this goal highlights the management of not only deforestation but also forest fires since sustainable forest

[9] John R. "Bob" Bridge. (2010) Mitigating Wildfire Disaster: Early Detection and Commitment - Disaster Recovery Journal - Dedicated to Business Continuity. Retrieved March 16, 2015, from www.drj.com/articles/online-exclusive/mitigating-wildfire-disaster-early-detection-and-commitment.html

[10] UN/ISDR, (2007). Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters. pp5-10 Retrieved 17 March 2015, from http://www.unisdr.org/files/1037_hyogoframewo

[11] UNEP (2009), "Kenya: Atlas of Our Changing Environment." Division of Early Warning and Assessment (DEWA) United Nations Environment Programme (UNEP) P.O. Box 30552 Nairobi 00100, Kenya

[12] GoK, (2009). Draft National Policy for Disaster Management in Kenya. p15,p20 Retrieved 17 March 2015, from http://www.ifrc.org/docs/idrl/765EN.pdf

[13] Wafula Luasi Nabutola, (2012). The Challenges and Opportunities for Integrated Disasters and Risk Management with Particular Reference to Policy, Legislation and Regulations in Kenya. *8 th FIG Regional Conference 2012 Surveying towards Sustainable Development Montevideo*. p4 Retrieved 17 March 2015, from http://www.fig.net/pub/uruguay/papers/ts07a/TS07A_

[14] Patrick Van Laake, (2012). Kenya Advances its REDD+ Readiness Roadmap: *Features & Commentary UN-REDD Newsletter 31 -- Kenya Readiness Roadmap*. Retrieved 17 March 2015, from http://www.un-redd.org/Newsletter31/Kenya_Readiness_Roadma

management requires integrated and participatory fire management[15].

It is imperative for communities to recognize and adopt the fact that disaster impacts can be reduced and not just play a reactionary role but proactive steps towards hazards reduction and/or vulnerability reduction.[16] Therefore this reaffirms the call and commitment of the PFM which is inclusive of the community in ensuring that deforestation and forest fires are curtailed through actions not only limited to mitigative measures but also preventative measures in order to ensure that risk from disasters are reduced.

The coastal forest in Kenya plays an important role in prevention of coastal degradation ranging from erosion, sedimentation, water filtering and nutrients recycling; and forest canopy providing sustainable habitat for wildlife and biodiversity which contributes greatly to the maintenance of balanced ecosystem. However Kenyan's dry coastal forests are vulnerable to degradation and deforestation which contributes to the susceptibility status of the coastal forest communities to environmental hazards. Research shows that continuous harvesting on non-PFM areas has nine times vulnerability to landslides than PFM areas.

The emergence of PFM have empowered the local community to partake in hazards management at the local level, while also receiving benefits which can reduce their possibility to disturb the forest, it contributes to poverty reduction[17] which decreases the vulnerability and increases resilience in relation to DRR. Also through REDD+ partnership programs, Kenya has received about 16.94 million USD between 2009 and 215 from Finland, Japan and Australia[18] –to fund projects not solely limited to reducing deforestation but also inclusively reducing forest fire hazards and increasing afforestation

[15] FAO (2003), Sustainable forest management and the ecosystem approach: two concepts, one goal. Wilkie M.L., Holmgren P., Castaneda F. FAO Working Paper FM 25. Forest Resource Department, Forest Resource Division, FAO Rome. p6 Retrieved 17 March 2015, from http://www.fao.org/forestry/6417-0905522127db12a324c6991d0a53571fa.pdf

[16] UN/ISDR, 2002. Living with risk: A global review of disaster reduction initiatives. The Secretariat of the International Strategy for Disaster Reduction (UN/ISDR), United Nations, Geneva, Switzerland, 382 pp. (http://www.unisdr.org)

[17] WRI. (2005). *The Wealth of the Poor. Managing Ecosystems to Fight Poverty*, World Resources Institute.

[18] FAO, (2015). Voluntary REDD+ Database. Retrieved 13 March 2015, from http://www.fao.org/forestry/vrd/entities/114#arrangements/q//t/2009-2016/f/all/r/all/a/0-12/p/1

since such projects are aimed at forest conservation and sustainability are captioned in the United Nation Framework Convention on Climate Change scope of REDD+[19]. Firebreak mechanisms established in partnership with the community through PFM is important in ensuring an effective DRR within the forest[20].

Linking REDD+ objectives and change in forest management –PFM is important to ensure cost savings of what would have otherwise be spent on climate stability[21], thus stressing the proactive approach of DRR since 90% of all natural disasters are from weather/climate related issues[22].

1.1 Statement of the Problem

The linkage between PFM and DRR is not well known, and are recent topic and therefore there is need to critically examine the interconnectedness of these two important approaches.

ASF is one of the most significant biodiverse forests in Kenya and the largest remaining fragment of indigenous coastal forests in East Africa[23], the country's 12% of the land originally covered by canopy has been reduced to about 1.7% its original size[24], poor governance of forest had previously lead to significant loss of forest due to logging and clearance for settlement[25], more also forest fires are not new hazards in Kenyan forests[26].

---

[19] Decision 1/CP.16. 2010. The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention, para 70. p12 Retrieved 13 March 2015, from http://unfccc.int/resource/docs/2010/cop16/eng/0

[20] ISDR, (2008). Report on the Status of Disaster Risk Reduction in the Sub-Saharan Africa Region. p37

[21] Ibid. p4

[22] GOK/MEMR, (2010). National Climate Change Response Strategy: Executive Brief; Ministry of Environment and Mineral Resources, April 2010. p4

[23] ASFMT, (2002). Arabuko-Sokoke Strategic Forest Management Plan, 2002-2027. Forest Department, Nairobi Kenya and BirdLife Int, Cambidge

[24] GOK/MEMR. National Climate Change Response Strategy

[25] Bussmann, R.W 2006. Vegetation zonation and nomenclature of African mountains – An overview. Lyonia Journal of Ecological Application, 11: 41-66; Ochieng, E.,Giri, C.P., Tieszen, L.L., Zhu, Z., Singh, A., Loveland, T.R., and Duke, N., 2010, Ecosystem goods and services and the status and distribution of mangrove forest of the world [abs.], in ACES—A Community on Ecosystem Services, Gila River Indian Community, Phoenix, Ariz., 6-9 December 2010, Abstract Book: U.S. Geological Survey and the Institute of Food and Agricultural Sciences, University of Florida, p. 84.

[26] Sheila Reed, (1997). Op.cit

There have been significant disturbance of the Kenyan forest resources – in terms of deforestation and forest fires –leading to the current endangered status of the Kakamega Forest, Mau Forest and Karura Forest, prior to 2003, there is a turn towards the largest dry coastal ASF although much of it undetected[27], -through deforestation or selective logging for commercial wood products as well as fuel and pole-wood collection for domestic use by growing FAD population[28].

Environmental degradation and other anthropogenic activities are mostly the cause of most disasters, and the environmental management tool is yet to fully utilize disaster reduction concept in DRR[29], thus there is need to reinforce the significance of disaster mitigation and prevention in environmental issues, this contributes to enhanced disaster management capacities based on long term environmental management[30].

Therefore there is need to investigate the role of PFM in ensuring the reduction of hazards and prevention of disasters, preparedness and mitigation of disasters by forest management stakeholders.

1.2 Research questions

1. What are the hazards and vulnerability in ASF areas?
2. What are PFM policies and practices that are related to DRR in ASF areas?
3. What are the roles of PFM actors in DRR within the ASF areas?
4. What are the challenges faced in DRR policy and practices in ASF forest management?

[27] ASFMT, (2002). Op.cit

[28] BirdLife, International, (2003). BirdLife's online world bird database for bird conservation. Version 2.0 BirdLife International, Cambridge, United Kingdom. http:www.birdlife.org

[29] ISDR, (2004), Living with Risk: A global review of disaster reduction initiatives, UN/ISDR, Geneva, Switzerland

[30] UNEP (2005b) 'Environmental Management and Disaster Preparedness: Lessons Learned from Tokage Typhoon of Japan' UNEP: Osaka.

1.3.0 General objective

The general objective of the research study was to examine DRR linkage with PFM in ASF.

1.3.1 Specific Objectives of the Research

1. To examine the hazards and vulnerability in ASF;
2. To review PFM policies and practices related to DRR;
3. To establish the role of PFM actors in DRR within the ASF;
4. To examine the challenges faced in DRR policy and practices in ASF forest management.

1.4 Justification of the Study

Forest resources are continually harnessed with less protection and without greater awareness of the significance it plays in prevention of extreme events that could threaten the livelihood and properties of not just the immediate forest environment and community forest areas but also the world in general since the impacts from disasters can be transnational. The promotion and involvement of DRR in PFM approaches needs to be assessed in order to provide adequate database about how forest management is constitutively associated with DRR. ASF is considered as one on the largest significant forest in east African region, it has obviously faced management knowledge and suggestions on how disasters can be better prevented or mitigated through community effort and ownership; and public partnership approach.

This study focuses on the challenges of ASF –being the largest remaining indigenous forest fragment of the East African coastal Arc –those challenges have subsequently shaped the vulnerability of the environment to hazards. And thus the study is useful to addressing the hazards and vulnerability that exists, and how to best strategize to ensure that disaster risks are reduced.

1.5 Scope and Limitation of the Study

The study will better inform policy makers to promote legal framework and enhance institutional facilities to better equip the potential of DRR in PFM. Using a case study of ASF, this study outlines the role of PFM on DRR in forest hazards and vulnerability management of the forest through the PA approach, Co-Management approach and CBNRM approach at the local level. It further examines the challenges of instituting DRR approaches in PFM policies and practices. The study was confined to ASF, and focuses on the equipped mechanisms on DRR. It highlights the practices, readiness and shortfall of PFM practices in terms of institutional, legal and technical aspects using the lens of DRR.

The first objective outlines the hazards and vulnerability in ASF. The second objective outlines the PFM policies and Practices related to DRR employed by ASF PFM participants. The third objective examines the role of state, civil society organizations (CSOs), non-governmental organizations (NGOs), Community Based Organizations (CBOs) and community actors in DRR within the forest; and the final objective explains challenges faced in DRR policy and practices in forest management. The study is limited to stakeholders in PFM and confined to hazards that can be traced to anthropogenic forest practices on disaster prevention and mitigation spectrum. Thus the study is not generalized to all forests' PFMs nor other environmental hazards caused or induced by non-anthropogenic forest factors. National Disaster Operation Centre, Kenya (NDOC) was interviewed as part of the key informants but NDOC provided no information due to their limitation to disaster related operations and data within the ASF area.

1.6 Definition of Terms

The following definitions applied for the purposes of this research project.

Deforestation refers the direct human-induced conversion of forested land to non-forested land[31], subsequently resulting to minimum of 10% long-term reduction threshold of the original canopy cover[32].

Disaster -an anthropologically influenced event, -be it natural or technological, -is a serious disruption of the functioning of a community or a society causing perverse human, physical, economic or environmental losses, which exceed the ability of the affected community or society to cope, using its own resources.[33]

Disaster mitigation is Structural and non-structural measures undertaken to limit the adverse impact of natural hazards and technological hazards induced by effects of environmental degradation.[34]

Disaster prevention is activities to provide outright avoidance of the adverse impact of hazards and related environmental disasters.[35]

Disaster risk reduction is the systematic development and utilization of policies, and strategies to reduce vulnerabilities and disaster risks throughout a society, to prevention or to mitigation adverse impact of hazards, within the context of sustainable development.[26]

Environmental Hazards –will refer to threats to people and their valuables due to environmental factors[36] as a result from the significant effects from deforestation and forest disturbances which at long-run induce other hazards.

---

[31] Lanly J. P. (2003), Deforestation and forest degradation factors, Paper to World Forestry Congress XII, Quebec City, Canada. http://www.fao.org/DOCREP/ARTICLE/WFC/XII/MS12A-E.HTM
Murshed, Z. Bangkok, 2006. Community-Based Disaster Risk Management for Local Authorities: *Participants Workbook.* Asian Disaster Preparedness Centre (ADPC).

[32] FAO, (2001), Global forest resources assessment 2000, FAO Forestry Paper 140, FAO, Rome

[33] UNEP (2005b). Op.cit

[34] ISDR, (2004). Op.cit

[35] UNEP (2005b). Op.cit

[36] Cutter, S. L. (Ed.) (2001a). American Hazardscapes: The Regionalization of Hazards and Disasters. Washington DC: Joseph Henry Press.

Forest degradation is the decrease in the quality and/or condition of different forest ecosystem components -vegetation layer, fauna, soil, which negatively affects the interactions between these components[37], and thereby lowering its capacity to supply products and services[38].

Forest products – these includes fruits, herbs, honey, butterflies, silk moths, medicinal plants, fuel wood. It also includes non-timber forest products (NTFP).

Hazards are a potentially damaging event, and/or human activity, that can result to the death or injury, property loss or damage, social and economic disruption, or environmental degradation.[39]

Hazards mitigation –activities aim to reduce the loss of life, injuries and damage to property and environment from disasters in the longer term. [31] The individuals, FAD, and CFA along with other forest management stakeholders have an important role in mitigation. The joint role of community and the government is important as the community is directly exposed to such hazards and may lack the technicality involved which is made available by the government.

Non-timber forest products – these includes pole wood, grass, wood for carving, firewood.

Participatory forest management is a forestry management based on traditional system and/or new resources management system, aimed towards shared objective of sustainability and conservation of forest and its resources, undertaking by partnering-stakeholders representing –the rights and roles of different members of the local community inclusive of NGOs through CBNRM and –government's role through policy implementation and enforcement in free and PA.

Protected Areas are forested areas mainly under the control and management of the state and with weak local participatory management by the Community Based Organisations (CBOs).

Vulnerability is set of conditions and processes as a result from economic, physical, social, and environmental factors, which increase the susceptibility of a population to hazards impacts.[40]

[37] Lanly J. P. (2003), Op.cit
[38] FAO, (2001), Op.cit
[39] ISDR, (2004), Op.cit

CHAPTER TWO: LITERATURE REVIEW & THEORETICAL FRAMEWORK

2.1.0 Empirical Literature

2.1.1 Hazards and Vulnerability

An environmental hazard (EH) has been defined in hazard terms as threats to people and their valuables[41] –a chain reaction analyzed in Figure 2.1. ASF itself is threatened by deforestation and forest fire, manifested through the demand for wood –for domestic use by FAD population[42], -60% to 90% of them mainly on the eastern ASF ends are highly dependent on forest wood energy[43], -for carving to supply an ever increasing tourist populations; Harvesting of poles for construction[44]; carbon stock loss; harvesting of timber –has reduced Kenya timber by one-half[45]; poaching of animals; use of tree barks for ropes; wildlife damage; encroachment – demand for agricultural and settlements; mining due to large deposits of titanium reserve underneath ASF; and potential oil & gas explorations.

The anthropological relationships with nature usually give rise to the potentials of EHs[46] –particularly deforestation and forest fire –and losses associated with EHs are on the rise due to human influence on climate change. Between 1975 and 1998, EHs accounted for over $300 billion worth of property and crop loss; and about 9000 deaths[47]. In developing nations, death tolls are much higher than in developed countries where economic losses outweigh human losses[48]. Further, it is possible that impacts will escalate, as researchers

---

[40] ISDR, (2004), Op.cit

[41] Cutter, S. L. (Ed.) (2001a). American Hazardscapes: The Regionalization of Hazards and Disasters. Washington DC: Joseph Henry Press.

[42] BirdLife, International, (2003). Op.cit

[43] GOK/MEMR, (2010). Op.cit

[44] Wright, (1999)

[45] UNEP, (2015). Nairobi Convention: Contracting Parties. Kenya. http://www.unep.org/NairobiConvention/The_Co

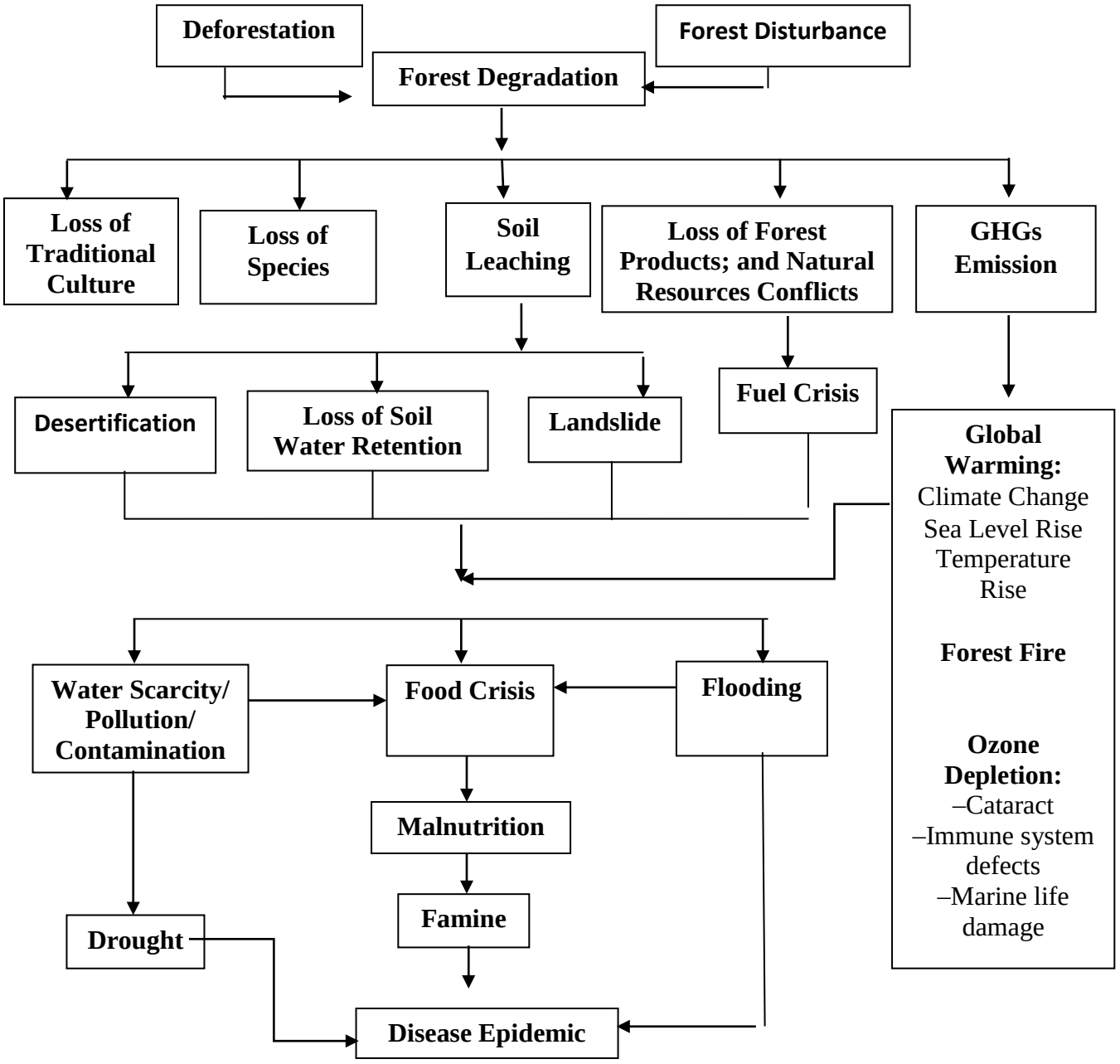
[46] Van der Wink, G., Allen, R.M., Chap?n, J., Crooks, M., Fraley, W., Krantz, J., Lavigne, A.M., LeCuyer, A., MacColl, E.K., Morgan, W.J., Ries, B., Robinson, E., Rodriquez, K., Smith, M., & Sponberg, K (1998). Why the United States is becoming more vulnerable to natural disasters". EOS, Transactions, American Geophysical Union, 79(44), 533-537.

[47] Thomas, D. S. K., & Mitchell, J. T. (2001). Which are the most hazardous states? In American Hazardscapes: The Regionalization of Hazards and Disasters. Chapter 6. Washington DC: Joseph Henry Press.

[48] Van der Wink, G., Allen, R.M., Chap?n, J., Crooks, M., Fraley, W., Krantz, J., Lavigne, A.M., LeCuyer, A., MacColl, E.K., Morgan, W.J., Ries, B., Robinson, E., Rodriquez, K., Smith, M., & Sponberg, K (1998).

portends that a warming climate may increase extreme weather events[49]. The increasing environmental degradation has giving rise to the emergence of natural hazards through

Figure 2.1 Flowchart of Forest Related Disasters



Source: Author, 2015

[49] McGuire, B., Mason, I., & Kilburn, C. (2002). Natural Hazards and Environmental Change. New York, NY: Oxford University Press.

anthropogenic induction, acting as amplifier to disasters which could otherwise not have occurred with such degree of intensity, and thus increasing vulnerability to such extreme events, this is evident through the correlative effect of drought, flood and famine which further complicates the phenomena of the disaster effects in Kenya in form of climatic refugees and other forms.

2.1.2 Disasters as a Result of Environmental Hazards

All over the world, evidence exists of human intervened-disaster. Almost no remnants of the original vegetation remain around the Mediterranean Sea. In England, 90% forest loss has been accounted[50]. The Atlantic forest in Brazil has lost 7% of its original one million square kilometers coverage[51]. In sub-Sahara Africa, deforestation and forest fires significantly linked to induced drought and hydro-meteorological hazards are the main attributes to disaster mortality and economic loss[52]. Deforestation leads to land degradation and eventually desertification, thus increasing the vulnerability of populations to drought[53]. Drought is predicted to increase from 1% at present to 30% by the end of the 21st century[54]. The widespread droughts of 1984–1985 were the most catastrophic: estimated affected population was 8 million, 1 million human deaths, and significant livestock deaths were recorded in the Horn of Africa[55]. In the 2000 drought, nearly 100 000 people died in the same region[56], also over 8 million people faced starvation threat in the Horn of Africa in 2006 due to drought and food crisis[57].

---

[50] Garrett Nagle, (1999). Britain's Changing Environment: *Focus on geography.* Illustrated Edition, Nelson Thornes Publisher

[51] Houghton R A, 2005, Tropical deforestation as a source of greenhouse gas emissions. In: Moutinho P and Schwartzman S (eds), 2005, Tropical Deforestation and Climate Change, Instituto de Pesquisa Ambiental da Amazônia, Belém, Pará, Brazil, pp13-21.

[52] Dilley, M., Chen, R.S., Deichmann, U., Lerner-Lam, A., Arnold, M., 2005. Natural Disaster Hotspots. A Global Risk Analysis. The World Bank, Hazard Management Unit, Washington, DC.

[53] Timberlake, L. (1994). *Africa in crisis: The causes, the cures of environmental bankruptcy.* East African Educational Publishers, Nairobi.

[54] Burke E.J., Brown S.J., and Christidis N. (2006). "Modelling the recent evolution of global drought and projections for the 21st century with the Hadley Centre climate model", Journal of Hydrometeorology 7(5), 1113–1125.

[55] Webb P., Braun J., and Teklu T. (1991). "Drought and famine in Ethiopia and Sudan: An ongoing tragedy", Natural Hazards 4(1), 85–86

[56] UNICEF (2006). http://www.unicef.org.uk/emergency/

[57] Ibid

According to the UN, the 2006 floods, which succeeded the 2005 droughts, left about 1.8 million population affected and considered as the worst drought in the last 50 years in the region.[58]

The large area affected by wildfires has implications for short-term productivity and long-term land degradation processes, which eventually contribute to famine during drought periods. In Africa, the increasing anthropogenic fires and with combined effects of drought have destroyed biodiversity and reduce the regeneration capacity of the vegetation.[59] Although fires cause few deaths, but valuable resources are lost, and poverty is heightened. Means of livelihood are hampered like the destruction of pastoral lands which increases the finances of livestock feeding. Fire affects air quality and emits GHGs which in turn have hydrological implications such as run-off and may lead to soil erosion.

2.1.3 PFM Policies and Practices Related to DRR

In the 1980's the influence of Structural Adjustment Programme in Africa called for application of development theory through decentralization and public participation, this gave rise to subsequent devolution of resource rights by the government to downwardly accountable institutions. CBNRM is the management of land, forest, wildlife and water by collective local institutions, CBNRM (also CFM) is based on the scholarship of common property theory or participation theory[60] and resources governance, traditionally managed collectively for sustainability and thus seen as an inherent approach to DRR. The possible failure and poor performance of CFM[61] called for reinforced mechanism of 'protected areas' PAs and also establishing a co-management power sharing of PFM[62] on the fact that local communities institutions cannot be vested with sovereign autonomy.

[58] UNICEF (2006), Op.cit

[59] Goldammer J.G. and de Ronde C. (eds) (2004). Wildland Fire Management Handbook for sub-Sahara Africa. Global Fire Monitoring Centre (GFMC), Freiburg.

[60] Ostrom E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*, Cambridge University Press.

[61] Jones B, Murphree MW. 2004. CBNRM as a conservation mechanism: Lessons and directions. In *Parks in Transition: Rural Development, Biodiversity and the Bottom Line*, Child B (ed.). Earthscan: London, UK; 63-104

[62] Barrow E, Murphree MW. 2001. Community Conservation: From concept to practice. In *African Wildlife and Livelihoods: The promise and performance of community conservation*, Hulme D, Murphree MW (eds.). James Currey: Oxford, UK; 24-37

Forest protection in Kenya dates back prior to the colonial era[63] the sessional Paper No. 1 of 1957 also informed policies of forest protection, usage, and government control[64] but forest that were not gazette were almost totally deforested over a period of two to three decades[65], thus informed the development and conservation policy of 1994 and subsequently 2005 Forest Act. The emergence of PFM have empowered the local community to partake in hazards management at the local level, while also receiving benefits which can reduce their possibility to disturb the forest, it contributes to poverty reduction[66] which decreases the vulnerability and increases resilience –hazard-vulnerability reduction as an attribute of DRR employed in PFM.

There are various legal frameworks that have addressed environmental hazards globally, regionally and which in turn influences country's sustainability frameworks. Following the weakness of the earth summit in 1992 in Rio, Brazil was the Kyoto protocol in 1997 in Japan which resulted into 'Agenda 21' captioned mechanisms to reduce pollution; and encourage carbon trading by financing –through 'payment for environmental services'; and sustainable management and development of the existing forested zones aimed at reducing GHGs emission. Other international regimes which have helped shaped PFM are Convention on Biological Diversity (CBD); UN Convention to Combat Desertification (UNCCD); UN Framework Convention on Climate Change (UNFCCC). This was further seen as a driving force for Kenya to join the FCPF in 2010 which reaffirms its commitment to management of forest-induced hazards.

Most research indicates the effectiveness of PFM in forest sustainability[67] while others argue that there is no difference with non PFM areas[68]. In East Africa, particularly Tanzania, observed improvements in terms of improved water discharge and quality;

[63] WWF 1997. *Coastal Forest Conservation Unit Fact Sheet.* Nairobi, WWF - Eastern Africa Regional Programme Office.
[64] GoK, (1968). *A Forestry Policy for Kenya.* Nairobi, Government Printer. Session Paper No.1 of 1968.
[65] IUCN 1996. Forest cover and forest reserves in Kenya: policy and practice. Nairobi, IUCN. IUCN Eastern Africa Programme, *Issues in Conservation*: 24.
[66] WRI. 2005. *The Wealth of the Poor. Managing Ecosystems to Fight Poverty*, World Resources Institute.
[67] Blomley, T., Pfliegner, K., Isango, J., Zahabu, E., Ahrends, A. & Burgess, N.D. (2008) Seeing the wood for the trees: an assessment of the impact of participatory forest management on forest condition in Tanzania. *Oryx* **42**: 1–12.
[68] Persha, L. & Blomley, T. (2009) Management decentralization and montane forest conditions in Tanzania. *Conservation Biology* **23**: 1485–1496.

increased regeneration of degraded areas; reduction in unregulated and unsustainable levels logging, charcoal production and hunting of game; reduced fire incidence; reduced village revenue due to preventive illegal activities; reduced encroachment and conversion of forest lands to agricultural lands; and increased biodiversity[69] which in turn effects the improvement of forest related DRR. While low impact of conservation is seen in Kenya in both PFM zones and non-PFM zones, the PFM zones still have a greater conservation rate than the non-PFM zones[70].

The Kenyan forest fire policy outlined the creation of forest fire protection unit within the forest department (KFS) Headquarter, –tasked with: –planning, organizing, equipping, training and provision of effective fire pre-suppression and suppression at all tires of the KFS; –planning risk and hazard reduction implementation strategies; –and the development of holistic awareness programs on fire protection and control. While the district and station offices organize and supervise forest fire prevention and suppression within their area of jurisdiction.[71]

Firebreaks and forest boundaries are established and requiring regular maintenance to check potential fire-spread in-between forested zones and among FAD areas. Fire detention is carried out through ground patrols and fixed stations (fire towers) –with limitation of insufficient equipment like radio system, vehicle, motorcycle and bicycles. Also the post forest fire assessment mandates a comprehensive detailed report of the location, affected area, cost of suppression cost and the actual forest damage. The forest management agencies in efforts to incorporate the community through PFM, organizes public awareness campaigns through organized meetings prior to fire-danger-season in order to help inform proactive preventative forest fire action and reactionary forest fire approaches.[72]

[69] Ibid
[70] Western D, Russell S, Mutu K. 2006. *The status of wildlife in Kenya's protected and non-protected areas*, Kenya's Wildlife Policy Review Team.
[71] Peter Wass (2002). Kenya's Forest Resource Assessment: *Data Collection and Analysis for Sustainable Forest Management in ACP Countries - Linking National and International Efforts.* p13
[72] Ibid

2.1.4 DRR Role by PFM Stakeholders

The possibility of future disastrous events occurring can be prevented or mitigated through preventative practices. Preventative mechanisms in disaster management revolve around risk management.

Figure 2.2 Forest Management Zones: Criteria Management Objectives and Management Options

Zone/Sub-zone		Criteria	Management objectives (in order of priority)	Management options	Responsibility for implementation
1. Non-extractive Zone	1.1 Biodiversity conservation sub-zone	• Important biodiversity areas • Inaccessible areas • Representing all 3 major forest types • At least 25% of the total forest area	• Conserve and enhance the unique biodiversity of the forest	• Studies and research	• NMK • KWS • KEFRI
	1.2 Eco-tourism sub-zone	• Known bird watching sites • Other wildlife sites • Areas accessible by roads and trails • At least 25% of the total forest area	• Conserve and enhance the unique biodiversity of the forest • Enhance forest habitats • Generate revenue for sustainable forest management	• Studies and research • Habitat improvement • Eco-tourism development (trails; signs; bird watching facilities) • Awareness raising	• KWS • Local communities
2. Subsistence Zone	2.1 Community use sub-zone	• Up to a maximum of 2 km from forest boundary (western side villages) • Up to a maximum of 1 km from forest boundary (eastern side villages) • Up to 1 ha per household	• Contribute to meeting subsistence needs and improving livelihoods of forest-adjacent communities • Improve and develop forest condition and utilisation potential • Conserve and enhance the unique biodiversity of the forest	• Fuelwood and pole harvesting • NTFP and medicinal plant collection • Tree planting (enrichment planting) • Rehabilitation of degraded areas • Carving wood extraction	• Local communities • FD
	2.2 NTFP use sub-zone	• Up to 3 km from the forest boundary (western side) • Overlapping with sub-zone 2.1, but also extending beyond it	• Contribute to meeting subsistence needs and improving livelihoods of forest-adjacent communities • Conserve and enhance the unique biodiversity of the forest	• NTFP and medicinal plant collection • Other non-extractive forest use, such as bee-keeping and butterfly-farming	• Local communities • FD
3. Commercial Zone		• Existing plantation areas	• Improve and develop forest condition and utilisation potential • Reduce pressure on natural forests • Generate revenue for sustainable forest management	• Silvicultural practices • Harvesting • Replanting	• FD • Local communities
4. Intervention Zone		• Outside the forest reserve • Sub-locations bordering the forest • Community willingness • Demand for forest products	• Contribute to meeting subsistence needs and improving livelihoods of forest-adjacent communities • Reduce pressure on natural forests	• On-farm tree planting • Tree nurseries • Problem animal control • Agroforestry • Beekeeping • Butterfly farming • Schools and education programme • Eco-tourism • Water source development	• Local communities • KEFRI • FD • NMK • KWS • Schools

Sources: Arabuko Sokoke Forest Management Plan, 2002

Risk (R) = Hazard (H) x Vulnerability (V) / Capacity (C) [73]

As mathematically illustrated above, forest management practices involves the minimization and reduction of hazards; and vulnerability is directly reduced by

[73] ISDR (2004). Op.cit

efficiently increasing capacity of human, knowledge and technical practices in forested areas –this is inclusive of PFM participants working in their various capacity to reduce risks emanating from poor forestry managements as illustrated in figure 2.2.

Studies indicated that CFAs are more directly engaged with EHs management at the local level than the KFS and other state actors which are more aligned to natural resource control, vital decision-making processes, and allocation of benefits[74]. As at 2005 about 76 CFAs out of 196 CFAs have formulated forest sustainability plans[75] which captures the reduction of EHs. ASFADA engages in ensuring forest projects are transparent; championing knowledge transfer and training because they are equipped with indigenous forest management skills; Tree planting and other forest management activities which can reduce EHs. For example the FAD of Loita Maasai forest uses the forest products to treat and prevent many diseases, have access to forest pastures, reduced forest disturbances with other PFM practices saved the community of significant effects of the 1993 drought[76]. The height of collaborative practice in ASF can be seen in late 2014 when ASFADA, FoASF Nature Kenya, Kenya United Against Poaching among other CFAs, NGOs, conservationist and environmentalist stopped Comac Energy Kenya from conducting seismic survey –which could have eventually led to oil exploration in Block L16 –an area covering Arabuko Sokoke, Magarini, Watamu, Kilifi, Ganze, and Malindi. The exploration could have posed threat to about 103, 784 acres of forested land, countless plants and animal species; also 8,000 FAD that depends on the FP like honey produced by bees that pollinates the forest; contamination of the water catchments which in turns threatens the population and species whose survival are dependent on the water source.[77]

---

[74] Western D, Russell S, Mutu K. 2006.

[75] GoK, (2005). Kenya Forest Act 2005.

[76] Loita Naimina Enkiyia Conservation Trust Company (1994a). *Forest of the Lost child - Entim e Naimina enkiyio: A Maasai conservation success threatened by greed.* Nairobi, Kenya; Loita Naimina Enkiyia Conservation Trust Company (1994b). Statement by the Loita Naimina enkiyia Conservation Trust to the second session on the Intergovernmental committee on the Convention of Biodiversity. *Forest , Trees and People Newsletter* 25: 45.

[77] FoASF, (2015). *Friends of Arabuko Sokoke Forest – David Ngala*. Retrieved 28 January 2015, from http://davidngala.wildlifedirect.org/tag/friends-of-arabuko-sokoke-forest/; One Green Planet, 2015. *Oil Exploration Threatens Kenya's Arabuko Sokoke National Forest and its Animals*. Retrieved 28 January 2015, from http://www.onegreenplanet.org/animalsandnature/oil-exploration-threatens-kenyas-arabuko-sokoke-national-forest-and-its-animals/

Governments' initiation of non-forest actors in forest management has reduced conflicts over natural resources[78]. In Kenya, the government has committed herself in ensuring that communities play an active role to increase the forest cover from 2% to 10%[79], a good practice and incentive towards increasing forest cover and decrease forest degradation and disturbance[80].

Prior to 2005 PFM practices negatively affected the conservation of forest, greatly influenced by the governments' monopolistic forest management practices[81]. As at 2007, due to the evolution and transformation of PFM, and there have been synergies in practices[82] –of the government & - of the non-state actors towards forest resource protection which translate into environmental risk reduction. For instance, the zoning system of sectioning ASF into four zones has made mitigation practices of not disturbing the forest to be systematically addressed through establishment of control and encouragement of habitat conservation and improvement, allowing study and research activities, and awareness development and capacity building. PFM practices stabilizes forest slope which protects the FAD and the communities beyond against landslides; combined technological and engineering driven environmental management have the potential to reduce risks from EHs (see Figure 2); and landmass protection through afforestation, restoring wetlands to maximize flood regulation are management practices that reduces disaster risks while sustaining livelihood and biodiversity around the forest community and beyond[83].

[78] Yemshaw Y, Amente G. (2003). Nature of confl ict and resolution strategies in Modjo Forestry project. Eastern and Central Africa Programme for Agricultural Policy Analysis (ECAPAPA) report

[79] DRSRS and KFWG, (2006). Changes in Forest Cover in Kenya's Five Water Towers, 2003-2005. Department of Resource Surveys and Remote sensing and Kenya Forests Working Group.

[80] Ibid

[81] Nurse, M.C. & Edwards, S.R. 1993. Strategies for Sustainable Conservation of Forests Under Threat from their Adjacent Communities. KIFCON Kenya and Birdlife International.

[82] Ongugo, Paul O. (2007): Participatory Forest Management in Kenya: Is There Anything for the Poor?, Proceedings: International Conference on Poverty Reduction and Forests, Bangkok, September 2007

[83] Helsinki, 2011. Strategy Note for Forest Governance Reform in Kenya. Final Draft by: Tapani Oksanen, Michael Gachanja and Anni Blåsten, Indufor for the "Miti Mingi Maisha Bora – Support to Forest Sector Reform in Kenya" (MMMB) Programme.

2.1.5 Challenges of Sustainable DRR in PFM

In Kenya, the forest sector witnessed reformation through the decentralization aimed at forest sustainability and development subsequently having a positive reduction effect on environmental hazards thereby preventing and/or mitigating the potentiality of environmental disasters. However the increased process may have been facilitated by an interior motive of personal gain –through corruption and unaccountability rather than by national interest[84], as seen in cases where forest resources were used as political power and as such the control over such natural resources are passed to political allies[85]. For example the Ololua forest turned into a quarrying site; over- exploitation of timber in Mt. Kenya forest; forest encroachment for housing in Karura forest. Also corruption has undermined accountability –of forest projects and benefits.[86] Before 2003 the Kenya forest cover was about 2% of the total land mass[87] but tremendous change have been witnessed as it has increased to about 6% forest cover in 2010[88] and 6.99% in 2014[89] which is still below the constitutional requirement of 10%. This is due to a number of challenges like the non-implementation of large aspects of legal frameworks by the government have hindered illegal tracking activites[90]; lack of an existing explicit disaster management institution tasked on forest-environmental hazards mitigations; statistical gap of knowledge and awareness; policy gap on import and export policy to address tariffs and taxes reduction on non-charcol carbonated products to reduce burden on local use of charcoal[91] ; poor institutional linkage between research, education and management institutions[92]; inadequate funding and heavy reliance on donor funding.[93]

---

[84] Edmund Barrow, Helen Gichohi, and Mark Infield, 2000. Rhetoric or Reality? *A Review of Community Conservation Policy and Practice in East Africa*. Pp95

[85] Dilys Roe, Fred Nelson and Chris Sandbrook.. CMNR in Africa: *Impacts, experiences and future directions* pp28

[86] Ibid

[87] FAO 2003b. FOSA: Sub-regional Report, East Africa. FAO, Rome. 54 p.

[88] FAO (2010): Forest Resources Assessment Report.

[89] MEWNR, 2014. *Ministry of Environment, Water and Natural Resources:* Forest policy 2014. GoK

[90] Matiku, P., C. Mireri, and C. Ogol. (2011b). Participatory natural resource management-policy and institutional framework (Part 1). *Environmental Policy and Law* 41(4-5): 232-239. pp115

[91] KFS & MEWNR, (2007). Forest Law Enforcement and Governance in Kenya: *A paper prepared for the East African Community-led regional process in the framework of the Ministerial Declaration, Yaoundé, Cameroon, October 16, 2003 on the Africa Forest Law Enforcement and Governance (AFLEG)*

[92] Matiku, P., C. Mireri, and C. Ogol. (2011b). Op.cit

[93] DRSRS and KFWG, (2006). Op.cit

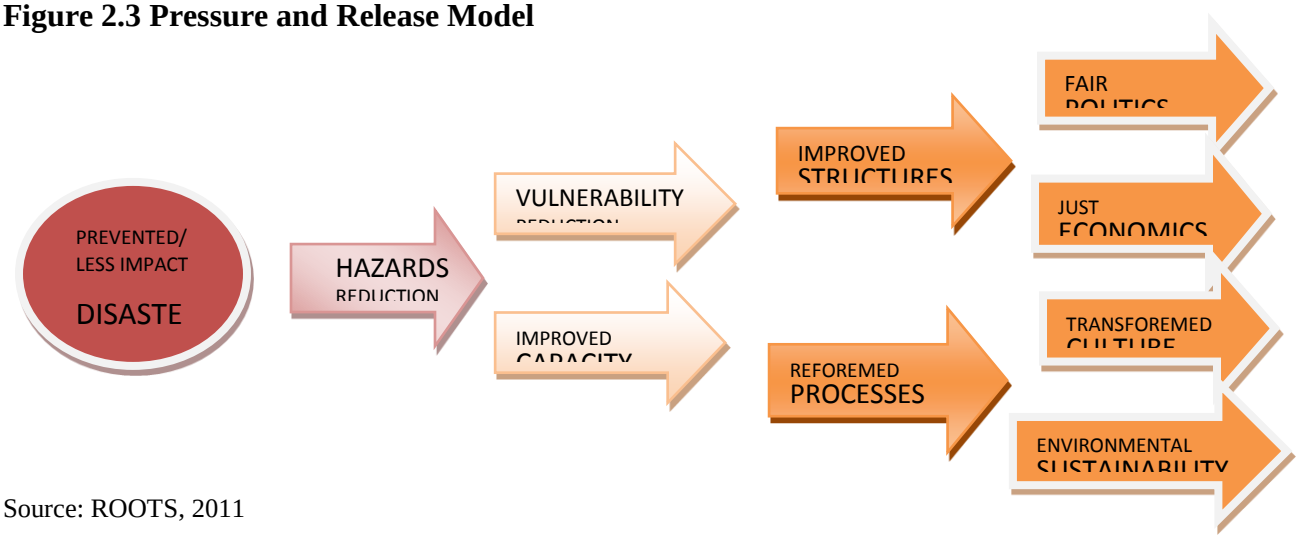
The communities are actively involved but faced with facilitative and capacity challenges[94] and internal-organizational challenges[95].

2.2.0 Theoretical Framework

2.2.1 The Theory of Risk Reduction and Participation

Theory of risk reduction and theory of participation fused into a participatory risk reduction conceptual model was applied into the study of this research. The pressure and release model of risk reduction theory by Blaieke et al is reversal of crunch model indicating how hazards and vulnerability can be reduced through mitigative and preventative practices by sustainable and management intervention on hazards and also reducing the progression of underlying and dynamic causes to ensure safe condition[96]. (See figure 2.3).

Figure 2.3 Pressure and Release Model



Source: ROOTS, 2011

The theory of participation by the framework of Arnstein recognizes different levels of participation from very weak manipulated participation to genuine participation[97], stressing best participation at the highest level of citizen involvement. This led Burns et

[94] Ongugo, P.O., M.T.E. Mbuvi, J.O. Maua, C.K. Koech and R.A. Othim. (2007). Emerging Community Institutions for PFM process Implementation in Kenya. Paper presented to the 3rd International PFM Conference. Addis Ababa, Ethiopia..

[95] FEFRI, 2009. Community Forest Associations in Kenya: *challenges and opportunities* by C. K. Koech, P. O. Ongugo, M. T. E. Mbuvi and J.O. Maua, 2009

[96] Blaikie, P., T. Cannon, I. Davis, and B. Wisner. (1994). At Risk: Natural Hazards, People's Vulnerability, and Disasters. London: Routledge.

[97] Arnstein, Sherry R (1969) 'A Ladder of Citizen Participation' in Journal of the American Planning Association , Vol. 35, No. 4, July, pp. 216-224

al to modify the Arntein ladder of participation to ladder of empowerment[98] where citizen can be effectively involved at various level of participation to ensure the desired goals are met[99].

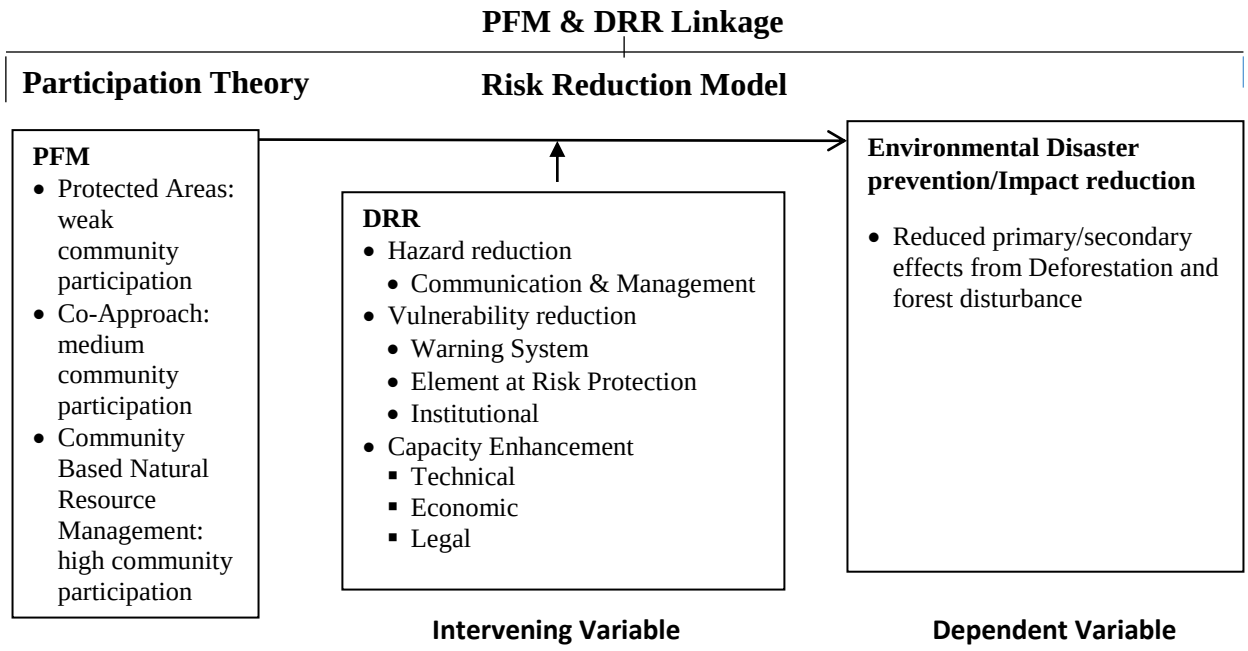
2.2.2 Conceptualization

The participatory risk reduction conceptualization model for this research (in figure 2.4) combines the forest related applied theory of participation and the forest-'pressure and release' model in the theory of disaster risk reduction. The model indicates how PFM practices and structures/ organizations enhance capacity building for example through use of indigenous and improvised knowledge; reduction of vulnerability for example through improved forest-plantation practices and built animal protection barriers; hazard reduction for example through REDD mechanism practices; and hazards impacts reduction for example through mechanisms like water catchment protection, sustainable assess to forest products.

[98] Burns, D et al (1994) The politics of decentralisation, London: Macmillan

[99] CAG Consultant. Participation: *A theoretical context*. Retrieved 5 February 2015, from http://webcache.googleusercontent.com/search?q=cache:pEp4qBkYPMwJ:www.cagconsultants.co.u

Figure 2.4 Conceptual Model



Source: Author, 2015.

However there are limitations the pressure and release model informed the application of the model above to only reduce environmental disaster and/or impacts from disaster (see figure2.4). The pressure and release model (figure 2.3) overgeneralized on the fact that political, economic and social *(environment and culture)* transformed processes will eventually lead to hazard and vulnerability reduction and thus the neglection of perception and interpretation of disaster events subjectively[100]. Also the model of Blaike et al was conceptualized in the academic based environment of the Western nations and cannot entirely fit into a different principles and value systems of the developing or under-developed society, and in most cases viewing the society as dangerous one that always needs intervention[101].

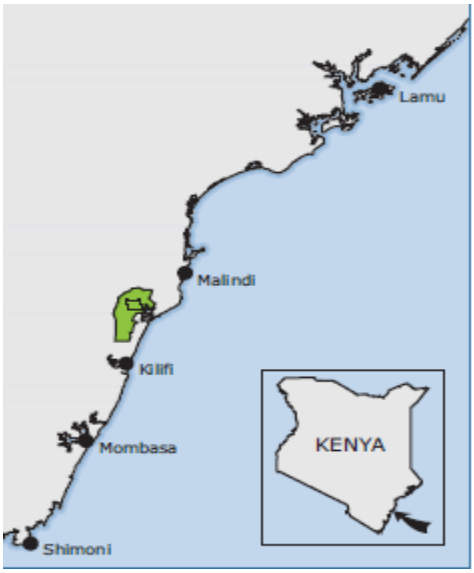
[100] Hewitt, K. (1997). Regions of Risk: A Geographical Introduction to Disasters. Essex, Longman.
[101] Bankoff, G. (2003). Cultures of Disaster: Society and natural hazards in the Philippines. London, Routledge Curzon

CHAPTER THREE: METHODOLOGY

3.1 Study Area

The study was carried out at ASF –an indigenous forest along the East African Arc located in Kenyan coast between Kilifi and Malindi Districts, 110km north of Mombasa and covering about 41,600 ha[102] (see figure 3.1) and the ASF is divided into four PFM zones. Arabuko Sokoke derives its name from the Waata tribe word *arbi huk'ko sokoke* meaning *forest of the thin elephant*[103]. ASF was gazzetted in 1930 as Protected Area but decentralized in 2005 following the Kenyan Forest Act 2005. The Arabuko Sokoke Forest Adjacent Dwellers Association (ASFADA) or ASF community formed in 1999 comprises of about 152,000 dwellers drawn from 50 villages, ASFADA is an integrative body of

Figure 3.1 Location of Arabuko-Sokoke Forest



Sources: Arabuko Sokoke Forest Management Plan, 2002.

Community Forest Associations (CFAs) which includes –Arabuko (ACFA), Sokoke

[102] GOK/MEMR. National Climate Change Response Strategy

[103] Guardian, 2012. Environment –Guardian weekly outlook on international development: *Conservation is priceless for Kenyan* forest by Daniel Sitole. Tuesday 21 February 2012 13.59 GMT
http://www.theguardian.com/society/2012/feb/21/arabuko-sokoke-kenya-forest-conservation

(SCFA) and Gede (GCFA).[104] ASF is managed by the GoK forest management agencies and the ASFADA –with over 600 membership –under a zoning system of protected areas, Co- management areas and community forest management areas.

3.2 Research Design

This study used descriptive research design. It seeks to establish disaster risk reduction practices employed in PFM that contributes to sustainable environmental conditions in ASF. It also suggests recommendations to help improve DRR approaches to help balance the challenges of sustainable practices affecting such practices.

The units of analysis was the forest adjacent community, –in ASF. The unit of observation was individuals in CFAs and records from the GoK agencies that manage the ASF.

3.3 Target Population

The target population was the ASF community comprising of three CFAs –Gede (GCFA), Sokoke (SCFA) and Arabuko (ACFA); government agencies comprising of KFS, MEWNR, KEFRI, NMK; and other forest organisations –ASFMT, Aroche Kenya, Nature Kenya and FoASF.

3.4 Sampling Procedures

The study employed a multi-stepped combination of probability and non-probability sampling. Purposeful sampling was used to select three community forest associations (CFAs) namely Arabuko (in the forest-North), Gede (in the forest-East) and Sokoke (in the forest-South). A purposive sample frame of 150 was selected from the ASFADA, –50 each from the three CFAs. This purposeful sample frame selection[105] – *the logic and power of purposeful sampling lies in selecting information rich-cases for the study in-*

[104] GOK/MEMR. National Climate Change Response Strategy

[105] Patton M.Q. (1990), Qualitative Evaluation and Research Methods. 2nd edn. Sage, Newbury Park, California.

depth was based on their ability to understand disaster themes and articulately recall disaster incidents; this was fulfilled by ensuring the selected respondents met the following criteria –having at least basic primary education, age of over 18 years and head of household. A sample of 20 from each of the three CFAs was selected using simple random sampling to get a sample size of 60. The 60 respondents –20 respondents from each CFAs was administered with the questionnaire.

Purposive sampling was used to identify 8 key informants, one each from 4 GoK forest management agencies –KFS, MEWNR, KEFRI and NMK; 2 forest management groups –ASFMT, and FoASF; and 2 Non-Governmental Organizations –Arocha Kenya, and Nature Kenya.

3.5 Data Collection Procedure and Tools

Secondary data used in the course of writing this proposal was obtained from library and internet resource features from books, journals, and other educational materials. Primary data was obtained using questionnaire and interview schedule from the community and organizations respectively.

The following research tools was employed: introductory letter to respondents; respondent consent form; questionnaire for ASF community; interview guide for data collection from key informants in the GoK forest management agencies, forest management groups and NGOs. Table 3.1 below shows how the research questions will be answered using the questionnaire and interview guide.

Table 3.1 Research questions in Questionnaire and Interview Guide

Research Questions	Questions in Research Tool
Research Question 1	Interview guide: **Q5, Q6 & Q7, Q8** for hazards and vulnerability respectively. Questionnaire: **Q9, Q11, & Q5, Q6, Q7,Q8, Q9, Q12** for hazards and vulnerability respectively
Research Question 2	Interview guide: **Q9** for policy and practices. Questionnaire: **Q10, Q13, & Q10, Q12** for policy and practices respectively
Research Question 3	Interview guide: **Q11** Questionnaire: **Q14, Q15, Q16, & Q17**
Research Question 4	Interview guide: **Q12** for policy and practices. Questionnaire: **Q18 & Q19** policy and practices respectively

Source: Author, 2015

3.5 Data Analysis and Presentation

Prior to fieldwork, questions were arranged in accordance to the research methodology and data collected in such order after fieldwork will be adequately scrutinized for completeness. The qualitative data was analyzed in accordance to categorization, content and study themes. The results were interpreted and presented using descriptive statistics. Data from questionnaires and interview schedules were documented; and thematic analysis was employed through the process of data conceptualization, coding and categorization. The data was examined to show how one concept influence another and also noting the relationship between the data from respondents and the key informants in order to allow the researcher to move from simple description of the respondents. The data findings were further legitimized using conductive analysis –through literature explanations supported by evidence from scholarly and previously researched materials.

3.6 Research Ethics

Considerations like professional practice – like ensuring data validity and research instruments reliability, and research ethics were adhered to by the researcher. The study observed confidentiality, non-forceful respondent compliance and consent of the respondent. Research approval was obtained from the University of Nairobi (UoN) and field research permit was obtained from the National Council for Science and Technology.

CHAPTER FOUR: DATA PRESENTATION, ANALYSIS, AND DISCUSSION

4.0 Introduction

This chapter plays emphasis on presentation, analysis and discussions on data collected. The data was collected using, questionnaires and interviews. The emphasis of this chapter was achieved through thematic examination, categorization and tabulation with inference to answering the research questions.

The study questioned 60 respondents from ASFADA and 8 interviewed key informants from MEWNR, KFS, KEFRI, NMK, Aroche Kenya, and Nature Kenya.

4.1 Demographics of Respondent

Table 4.1 Age of Respondent

	Arabuko	Gede	Sokoke	Total			
Age	Frequency	Frequency	Frequency	Frequency	Percent	Mean	Mode
19 to 26 years	1.0	6.0	4.0	11.0	18.3		
27 to 35 years	8.0	10.0	9.0	27.0	45.0		
36 to 44 years	8.0	3.0	5.0	16.0	26.7		
45 to 52 years	3.0	1.0	2.0	6.0	10.0		
Total				60.0	100.0	33.6	31.0

The respondent's majority –45% was aged between 27 and 35 years with most of them from Gede CFA followed by Sokoke before Arabuko, the arithmetic mean of the respondents' age is 33.6 years. One third –36.7% of the respondents was aged between 36 and 52 years with most of them from Arabuko, this attributive to the educational criteria of the respondents selection and also a validation that this study captured –mostly the age group that have high tendencies of forest experience.

Table 4.2 Gender of Respondent

	Arabuko	Gede	Sokoke	Total			
Gender	Frequency	Frequency	Frequency	Frequency	Percent		
Male	12.0	13.0	17.0	42.0	70.0		
Female	8.0	7.0	3.0	18.0	30.0		
Total				60.0	100.0		

Out of the 60 respondents, 70.0% were males while 30.0% were females, there were more male representation form Sokoke followed by Gede before Arabuko. Research shows females are usually underrepresented in Kenya[106]; this is due to lower educational opportunity and slower career mobility partly attributive to their time-consuming social family role in the household[107]. This signifies gender disparity in the forest community among those that have closer access to PFM engagements and the understanding of disaster.

Table 4.3 Period of Membership of Respondent

	Arabuko	Gede	Sokoke	Total			
Membership Period	Frequency	Frequency	Frequency	Frequency	Percent	Mean	Mode
1 to 3 years	8.0	7.0	6.0	21.0	35.0		
4 to 8 years	9.0	9.0	9.0	27.0	45.0		
9 to 12 years	3.0	4.0	5.0	12.0	20.0		
Total				60.0	100.0	5.9	6.0

Out of the 60 respondents, 45% majority have at least 6 years membership period, 35.0% of the respondents have been member of the association for at least 2 years, and 20.0% of them for at least 10.5 years. The arithmetic mean of the respondents' years of membership in their respective CFAs is 6 years, and in consideration of achieving the

[106] Ouma H. and Maina B.N. (2010) Vision 2030, social pillar gender analysis. In Society for International Development, p. 72–138

[107] Porat, K.L.(1991).Women in administration: The difference is positive.Clearing House, 64(6), 412-415. www.wpnet.com/cgi-bin/epwtop/page

objectives of this study, the 6 years membership period is enough for the respondent to give accounts of their learned and experienced events within ASF area.

4.2 Hazards in ASF and its Adjacent Dwellers

4.2.1 Threats to ASF area

There are a number of anthropogenic factors that can increases the level of forest disturbance and further, directly or indirectly influencing the risk or occurrence of disaster.

Those factors as shown below in Table 4.4, 63.3% of the respondent agrees that poaching is a threat –of whch greater threat is experienced in Arabuko, while 58.3% agrees to illegal logging and 31.7% to forest encroachment. Only 20.0% of the respondents agree to legal logging as a threat. It is important to note that as poaching takes the higher percentage –25.0% of all responses from the respondents, illegal logging and legal logging combined had 30.9% responses and 78.3% respondents' agreement which makes logging a greater threat than poaching –as applied to greater logging threat in Gede followed by Sokoke before Arabuko.

Table 4.4 Threats to the ASF and Adjacent Dwellers

Threat factors	Arabuko Number of response	Gede Number of response	Sokoke Number of response	Total Responses		Percent of Cases
				Number of response	Percent	
Poaching	16.0	11.0	11.0	38.0	25.0	63.3
Illegal logging	11.0	10.0	14.0	35.0	23.0	58.3
Encroachment	7.0	6.0	6.0	19.0	12.5	31.7
Agricultural Malpractice	7.0	5.0	4.0	16.0	10.5	26.7
Property/farm destruction	2.0	6.0	7.0	15.0	9.9	25.0
Logging (legally)	1.0	7.0	4.0	12.0	7.9	20.0
Non-timber forest products harvesting	2.0	5.0	3.0	10.0	6.6	16.7
Mining	3.0	4.0	0.0	7.0	4.6	11.7
Total	49.0	54.0	49.0	152.0	100.0	253.3

Forest disturbance have potential to increase vulnerability and hazards[108]. This leaves an indication that threat like legal logging, illegal logging, forest encroachment and mining that has greater frequencies and tendencies of tree-falling pose a greater threat to influencing deforestation which can also lead to other disaster risks. Increase in drought, flood and other extreme event will add to stress on water resources and food security, constraining development[109]. Likewise threats to ASF area –like agricultural malpractice, farm/property destruction, and non-timber forest product (NTFP) harvesting can create an avenue for short term risks to flooding and forest fires which greatly challenge food security.

4.2.2 Disaster Factors

Table 4.5 Disaster Experienced in ASF and the Adjacent Dwellers Community

Disaster experienced	Arabuko Number of response	Gede Number of response	Sokoke Number of response	Total Responses		Percent of Cases
				Number of response	Percent	
Flooding	5.0	11.0	7.0	23.0	21.9	38.3
Deforestation	6.0	8.0	7.0	21.0	20.0	35.0
Drought	5.0	4.0	5.0	14.0	13.3	23.3
Forest fire	3.0	6.0	3.0	12.0	11.4	20.0
Disease epidemic	6.0	1.0	4.0	11.0	10.5	18.3
Famine	1.0	3.0	3.0	7.0	6.7	11.7
Resource based conflict	1.0	4.0	2.0	7.0	6.7	11.7
Pollution	0.0	3.0	1.0	4.0	3.8	6.7
Fuel/water crisis	1.0	2.0	0.0	3.0	2.9	5.0
Landslide	0.0	2.0	0.0	2.0	1.9	3.3
Desertification	0.0	1.0	0.0	1.0	1.0	1.7
Total	28.0	45.0	32.0	105.0	100.0	175.0

The respondents identified major disaster types that have been experienced as flooding – prominent in Gede that the rest areas, deforestation –more tree loss in Gede, drought, disease epidemic, and forest fire -of high frequency in Gede, famine and resource based conflict in accordance the disasters experienced in ASF area.

[108] Blaikie, P., T. Cannon, I. Davis, and B. Wisner. (1994). Op.cit

[109] World Bank, 2006. Reengaging in Agricultural Water Management: Challenges and Options. World Bank Publications, 2006. p58

In Table 4.6, thematic analysis from the key informants' data shows 6 major disaster risk types namely deforestation, forest fire, flood, famine, drought and resource based conflict. This agrees with the respondents' account of disasters experienced and thus confirming those 6 disaster type as the disaster risk in ASF area. Disease epidemic with 18.3% respondents' agreement was influenced by plant/animal disease epidemic as indicated by the respondents under the disaster impacts, an indication for the most of the key informants to have ignored this disaster type since it is not human disease epidemic.

Table 4.6 Disaster risks in ASF as identified by the key informants

Disaster risk	Responses from Institutions that identified the risk	
	Numbers of Institutions that identified the risk	Name of Institution
Flooding	7.0	Ministry of Environment Water and Natural Resources; Kenya Forest Service; Kenya Forest Research Institute; National Museum Kenya; Aroche Kenya; Friends of Arabuko Sokoke Forest; Arabuko Sokoke Forest Management Team
Deforestation	6.0	Ministry of Environment Water and Natural Resources; Kenya Forest Service; Kenya Forest Research Institute; Aroche Kenya; Nature Kenya; Friends of Arabuko Sokoke Forest; Arabuko Sokoke Forest Management Team
Forest fire	5.0	Ministry of Environment Water and Natural Resources; Kenya Forest Service; National Museum Kenya ; Nature Kenya; Friends of Arabuko Sokoke Forest
Drought	5.0	Ministry of Environment Water and Natural Resources; Kenya Forest Research Institute; Aroche Kenya; Nature Kenya; Friends of Arabuko Sokoke Forest
Famine	3.0	Kenya Forest Research Institute; Aroche Kenya; Arabuko Sokoke Forest Management Team
Resource based conflict	3.0	Kenya Forest Service; Nature Kenya; ; Friends of Arabuko Sokoke Forest
Disease epidemic	2.0	Ministry of Environment Water and Natural Resources; Kenya Forest Service
Desertification	2.0	National Museum Kenya; Arabuko Sokoke Forest Management Team
Pollution	1.0	Kenya Forest Research Institute

Flooding, deforestation, drought, forest fire, famine and resource based conflict are common risks in tropical forest areas[110]. This indicates an inclusion of plant and animal diseases as an addition in the case of ASF area.

In Table 4.7, disasters are relatively experienced more in Gede than the rest areas. Most of the disasters occur in at least between 2 to 3 years –more often in Sokoke, while deforestation is exclusively continuous and gradual exclusive to deforestation.

Table 4.7 Disaster Occurrence in ASF and the Adjacent Dwellers Community

Disaster occurence	Arabuko Number of response	Gede Number of response	Sokoke Number of response	Total Responses		Percent of Cases
				Number of response	Percent	
continuous/gradual	6.0	8.0	7.0	21.0	20.2	35.0
at least in 1 year	1.0	6.0	3.0	10.0	9.6	16.7
at least in 2-3 years	6.0	15.0	19.0	40.0	38.5	66.7
at least in 4-5 years	13.0	11.0	2.0	26.0	25.0	43.3
at least in over 5 years	2.0	5.0	0.0	7.0	6.7	11.7
Total	28.0	45.0	31.0	104.0	100.0	173.0

[110] Donald A. M., and Jo-Ansie van Wyk. 2010. Climate Change and Natural Resources Conflicts in Africa. Retrieved 25 August 2015, from https://www.issafrica.org/uploads/Mono170.pdf

Table 4.8 Key Informants Account of Disaster Impacts in ASF Area

Institution	Disaster impacts
Ministry of Environment Water and Natural Resources	Food security is the important risk especially during drought; and also loss of lives and properties during floods.
Kenya Forest Service	Loss of harvest and properties
Kenya Forest Research Institute	Lack of food for humans consumption and animal grazing due to effects partly from forest disturbance; destruction of properties and crops due to flooding
National Museum Kenya	Property, animals and harvest losses
Aroche Kenya	Crop and livestock losses; lack of good food and water sources
Nature Kenya	Loss of incomes sources; loss of birds and non-timber forest products due to tree losses; loss of irreplaceable environmental aesthetics; diversion of water trails from their water catchment sources due to encroachment; and migration and reduction of birds, butterflies and other organisms due to forest disturbance.
Friends of Arabuko Sokoke Forest;	General disaster effects associated with flooding; human-animal conflict; and forest fires.
Arabuko Sokoke Forest Management Team	Loss of indigenous trees and medicinal forest products; loss of food and incomes sources; food and water scarcity, nutritional problems due to drought and famine.

The key informants stated the impacts of disasters in ASF areas that food security and property loss are the major themes of disaster effects. This agrees with the respondents' account.

Out of the 60 respondents, 98.3% agrees to farm/crop/water source damage –most from Gede areas. Food and water sources are damaged by forest disasters[111], especially flooding, aridity, drought and forest fires that can significantly increase the impact on local-level food and livelihood systems[112].

Table 4.9 Impact of Disaster in ASF area on the Adjacent Dwellers Community

Disaster Impact	Arabuko Number of response	Gede Number of response	Sokoke Number of response	Total Responses		Percent of Cases
				Number of response	Percent	
Farm/crop/water source damage	17.0	25.0	17.0	59.0	56.2	98.3
House/property damage	2.0	4.0	4.0	10.0	9.5	16.7
Disease and malnutrition	2.0	3.0	3.0	8.0	7.6	13.3
Deaths/displacement	1.0	3.0	0.0	4.0	3.8	6.7
No impact	6.0	10.0	8.0	24.0	22.9	40.0
Total	28.0	45.0	32.0	105.0	100.0	175.0

This trend is not exclusive to Kenya as most of the disasters affect food security of the population[113]. This is an indication that food security is most at risk in an event of disaster followed by property loss within the ASF area.

Table 4.9 showed that no impact which accounted 22.9% of responses –greater proportion from Gede –and this was as a result of the fact that those responses were indicated under deforestation impact column of the questionnaire. Environmental related hazards like drought, flood among others can be triggered to disaster by deforestation

[111] Global Majority E-Journal, Vol. 2, No. 1 (June 2011), pp. 31-45 The Water Crisis in Kenya: Causes, Effects and Solutions

[112] Samantha Marshall WRI, (2015). Climate Change in Nepal: Impacts and Adaptive Strategies | World Resources Institute. Retrieved 24 August 2015, from http://www.wri.org/our-work/project/world-resources-report/climate-change-nepal-impacts-and-adaptive-strategies

[113] UNDP, (2004). p.9 Op.cit

through its effects on the level of soil porosity, wind shade effects, atmospheric carbon dioxide (CO_2) and climate change.[114] This respondent's greater percentage indication of no deforestation impact, means the respondents had limited capacity to evaluate secondary effects of deforestation since it is mostly an indirect effect on the community. Food sources are those most affected with the area of Gedi facing larger impacts of food insecurity.

4.3 Vulnerability of ASF Adjacent Dwellers

Table 4.10 Educational Level of the Respondents

	Arabuko	Gede	Sokoke	Total	
Educational Level	Frequency	Frequency	Frequency	Frequency	Percent
Primary	8.0	3.0	3.0	14.0	23.3
Secondary -O'level	8.0	12.0	15.0	35.0	58.3
College -Certificate/Diploma	3.0	2.0	1.0	6.0	10.0
University Degree	1.0	3.0	1.0	5.0	8.3
Total				60.0	100.0

Out of the 60 respondents, 58.3% were secondary O'level holders –most from Sokoke, 23.3% were primary school certificate holders, 10% have college certificate/diploma and 8.3% had attained university degree. This reveals that about 81.6% of the respondents have not gone beyond secondary school stage. Education is linked to socioeconomic status, with higher educational attainment resulting in greater lifetime earnings, and lower education constrains the ability to understand warning information and access to recovery information.[115] Also the better educated tends to learn more and live healthier live[116], have diversified livelihood and increased access to financial and social resources[117], and

[114] ISDR, (2008). Op.cit

[115] Heinz Center for Science, Economics, and the Environment. 2000. The Hidden Costs of Coastal Hazards: Implications for Risk Assessment and Mitigation. Covello, Cal.: Island Press.

[116] Lutz, W., and K. C. Samir. 2011. Global human capital: integrating education and population. Science 333:587–592.

[117] Strauss, J., and D. Thomas. 2008. Health over the life course. Pages 3375–3474 in T. P. Schultz and J. Strauss, editors. Handbook of development economics, Volume 4. North-Holland Biomedical Press, Amsterdam, The Netherlands.

has greater resilience due to higher opportunity to reintegrate back into the society[118]. Little education increases vulnerability while the highly educated have decreased vulnerability[119]. Based on the fact that the methodology of their selection was on the respondent's ability to comprehend accounts of disaster themes, it is evident that the greater proportion of the community has lower educational levels which disenfranchised their high selection as respondents. Likewise, ASF areas there are high chances of higher vulnerability level due to lower educational level of the ASF dwellers population.

Table 4.11 Income Level of the Respondents

	Arabuko	Gede	Sokoke	Total		
Income (Ksh) in 30days	Frequency	Frequency	Frequency	Frequency	Percent	Mean
3,00 to 15,500	20.0	16	0	36	60.0	
15,501 to 40,000	0.0	4	20	24	40.0	
Total				60	100	20,350.3

Table 4.11 showed that most -60.0% of the respondents have monthly income (ksh) less than 15,500 with majority of them from Arabuko area while 40.0% have more than 15,500 with majority of them from Sokoke. The significant difference between the three communities can be attributed to the fact that Sokoke area is closer to the city of Mombasa followed by Gede before Arabuko and thus the area closer to industrialised area tends to have higher wage.

The ability to absorb losses and enhance resilience to hazard impacts are determinant to factors which includes income, wealth enables communities to absorb and recover from losses more quickly due to insurance, social safety nets, and entitlement programs; and its absence in form of low income or poverty increases vulnerability.[120] From World Bank

[118] Frankenberg, E., B. Sikoki, C. Sumantri, W. Suriastini, and D. Thomas. 2013. Education, vulnerability, and resilience after a natural disaster. Ecology and Society 18(2): 16. http://dx.doi.org/10.5751/ES-05377-180216

[119] Heinz Center for Science, Economics, and the Environment. (2000). Op.cit

[120] see Cutter, S. L., J. T. Mitchell, and M. S. Scott. 2000. ''Revealing the Vulnerability of People and Places: A Case Study of Georgetown County, South Carolina.'' Annals of the Association of American Geographers 90(4):713–37.; Peacock, W., B. H. Morrow, and H. Gladwin, eds. 1997. Hurricane Andrew and the Reshaping of Miami: Ethnicity, Gender, and the Socio-Political Ecology of Disasters. Gainesville, Fla.: University Press of Florida. ; Hewitt, K. 1997. Regions of Risk: A Geographical Introduction to Disasters. Essex, U.K.: Longman. ; Puente, S. 1999. ''Social

analysis, 15,500ksh is the minimum household poverty line for Kenyans[121]. Thus income above the poverty line indicates lower vulnerability and higher resilience likewise income below the poverty line indicates higher vulnerability and lower resilience. It is not mind boggling to find an indication from this research that about 60.0% lives below the minimum poverty threshold, as the Kilifi county statistics also agrees to 70.8% higher county poverty rate than the national rate of 45.9%[122].

Table 4.12 Occupational Level of the Respondents

	Arabuko	Gede	Sokoke	Total	
Occupation	Frequency	Frequency	Frequency	Frequency	Percent
Unskilled Labour	13.0	11.0	8.0	32.0	53.3
Service/Skilled Labour	2.0	5.0	7.0	14.0	23.3
Professional	1.0	3.0	3.0	7.0	11.7
Clerical	2.0	1.0	2.0	5.0	8.3
Unemployed	2.0	0.0	0.0	2.0	3.3
Total				60.0	100.0

In Table 4.12, 53.0% have unskilled jobs, 23.3% have skilled labour jobs, 11.7% of the respondents are professionally employed, 8.3% have clerical jobs, and 3.3% are unemployed. Most of the unskilled workers are from Arabuko while majority of the respondents having jobs above unskilled labour are from Sokoke.

Unskilled labour occupations suffers from low disposable income; and may be severely impacted by a hazard event, and may have to switch within unskilled jobs because their means of production is lost and may not have the requisite capital maintain former job –if

Vulnerability to Disaster in Mexico City.'' Pp. 295–334 in J. K. Mitchell, ed., Crucibles of Hazard: Mega-Cities and Disasters in Transition. Tokyo: United Nations University Press. ; Platt, R. 1995. ''Lifelines: An Emergency Management Priority for the United States in the 1990s.'' Disasters 15:172–76.

[121] Mywage.org,. (2015). Minimum Wage, Salary, Domestic Work in Kenya - MyWage.org/Kenya. Retrieved 17 August 2015, from http://www.mywage.org/kenya/home/salary

[122] Kilifi County, 2015. Kilifi Secondary Data Review As At February 2014 Introduction Summary. Retrieved 17 August 2015, from http://webcache.googleusercontent.com/search?q=cache:cBSOth5IF4kJ:https://www.hum

self-owned –and work in a timely fashion.[123] Professional or managerial jobs tends to have lower vulnerability while clerical, laborer and service sector jobs have increased vulnerability risks.[124] Most –88.3% of the respondents are not in professional or managerial jobs, this indicates a high vulnerability tendency within the ASF areas.

Table 4.13 shows that 81.7% of the respondents had between 1 to 7 persons in household while 18.3% have 8 to 14 persons. Families with large household sizes often have limited finances to outsource care for dependents, and thus works tirelessly between job and family responsibilities, this have effects on the level of resilience to and recovery from hazards.[125] The mean household size is 5.2, which is slightly lower than the 5.6 average Kilifi household size, and 0.8 higher than the Kenya national household size of 4.4[126]. This means that the respondents have decreased vulnerability level to evacuations, resilience, and recovery.

Table 4.13 Household Size of Respondent

	Arabuko	Gede	Sokoke	Total		
Household Size	Frequency	Frequency	Frequency	Frequency	Percent	Mean
1 to 7 persons	19	16	14	49	81.7	
8 to 14 persons	1	4	6	11	18.3	
Total				60	100.0	5.3

Out of all the responses on the awareness scheme/programmes about logging (legally), illegal logging, Poaching, Encroachment, NTFP harvesting, Mining, Agric. Malpractice, and Property/farm destruction; 53.3% indicated no awareness campaigns while only 46.7% signified that there was –about those threats. Low awareness amongst decision makers and the public about the factors and human activities that contribute to environmental

[123] Heinz Center for Science, Economics, and the Environment. (2000). Op.cit; Hewitt, K. (1997). Op.cit; Puente, S. (1999). Op.cit
[124] Ibid
[125] Blaikie, P., T. Cannon, I. Davis, and B. Wisner. 1994. Op.cit; Heinz Center for Science 2000. Op.cit ; Puente, S. 1999. Op.cit
[126] Kilifi county 2015.

Table 4.14 Awareness Provisions on Vulnerability of ASF Community

Awareness Campaigns on implication of threats to the ASF	Arabuko Number of Response	Gede Number of Response	Sokoke Number of Response	Total Responses		Percent of Cases
				N	Percent	
No awareness	11	23	22	56	53.3	93.3
There is awareness	16	22	11	49	46.7	81.7
Total	27	45	33	105	100.0	175.0

degradation and disaster vulnerability are aggravates disaster risk trends.[127] Increasing public awareness and public participation to reduce vulnerability to hazards.[128] This gives an indication of increased vulnerability on the population's half due to lower level of awareness.

Table 4.15 Early Warning System Provisions on Vulnerability of ASF Community

Early Warning System about threats to the ASF community	Arabuko Number of Response	Gede Number of Response	Sokoke Number of Response	Total Responses		Percent of Cases
				N	Percent	
No early warning system	11	23	22	56	53.3	93.3
There was early warning system	16	22	11	49	46.7	81.7
Total	27	45	23	105	100.0	175.0

Out of the 100% responses on whether there was warning systems, 53.3% indicated no provision of early warning system while 46.7% indicated that there were warning systems, an indication that there is early warning system in-place. Early warning is to provide individuals and communities exposed to disaster risk with accurate information

[127] UN/ISDR. 2003. Disaster Reduction and Sustainable Development: Understanding the links between vulnerability and risk to disasters related to development and environment United Nations/International Strategy for Disaster Reduction Disaster.
[128] Ibid

about an impending hazard as early as possible, allowing them to act in a timely and appropriate manner to reduce the probability of suffering, personal injury, death and property losses.

Increased sophistication in prediction technology, trained professionals and adequate finances are not effective if there remains poor communication amongst authorities and disaster managers.[129]

However, further illustrations on the roles of ASF PFM actors in Table 4.17 showed that out of the 46.7% responses stating that there is EWS, 41.9% were provided by the CBOs/NGOs while only 4.8% was either provided by the Government agencies or government agencies in-partnership with CBOs/NGOs. This is an indication that there is warning system in-place to reduce the vulnerability of the elements at risk but its effectiveness is weak due to poor interconnection between government agencies providing the information with reliable technology and professional staff as opposed to the quality EWS provided by community based organizations through the words of mouth in social groups.

Table 4.16 Personnel to Respond Provisions on Vulnerability of ASF Community

Personnel to respond	Arabuko Number of Response	Gede Number of Response	Sokoke Number of Response	Total Responses		Percent of Cases
				N	Percent	
There were personnel to respond	22	20	21	59	60.6	105.0
No personnel to respond	5	25	11	41	39.4	68.3
Total	27	45	32	104	100.0	173.3

In the case of after disaster provisions, 60.6% stated that there where personnel to respond and 39.4% stated that no personnel responded to them after disasters happened.

[129] Ibid

This indicates that the ASF communities are less likely to be vulnerable to disaster impacts since there are personnel to act. But within the communities, Arabuko is likely to have greater vulnerability since there was very low level of personnel response, while Sokoke might also be the least impacted due to the fact that there was higher personnel response ratio.

Table 4.17 Relief Resources to Respond Provisions on Vulnerability of ASF Community

Relief Resources to respond	Arabuko Number of Response	Gede Number of Response	Sokoke Number of Response	Total Responses		Percent of Cases
				N	Percent	
There were resources to respond	21	23	24	67	64.8	111.3
No resources to respond	6	23	8	37	35.2	61.7
Total	27	46	32	105	100.0	175.0

The Sokoke and Arabuko had no limitation of resources not provided after the events of disaster, while there where greater resources provision limitations in Gede community. The respondent indicated that the ASF community had grater –64.8% resource provisions in the aftermath of disaster.

The study identified stronger post disaster provisions where 60.6% of the responses agreed that there were personnel to respond to disasters, and 60.8% indicated that there were resources to respond. This leaves an argument that the pre-disaster provision negatively affects vulnerability while the post-disaster provisions will have positive impact.

Table 4.18 Factors Influencing the Vulnerability of ASF Community

Institution	Influencing factors
Ministry of Environment Water and Natural Resources;	Population growth and migration have increased pressure on forest resources exploitation and forest encroachment; and corrupt practices have aided logging.
Kenya Forest Service	Poverty, low level of relative risk awareness, logging and migration. Loss of harvest and properties.
Kenya Forest Research Institute	Migration as a result of the increasing population; logging aided by corruption and weak forest monitoring; poor agricultural and residential practice.
National Museum Kenya	Low educational level and ignorance; and migration to forest areas
Aroche Kenya	Low awareness about cultural and environmental preservation has influenced ignorance; and migration. Poverty due to lower income has influenced intolerable practices like aided logging, encroachment and poaching.
Nature Kenya	Low education; raising population; bad logging practices and forest disturbance influences and increases the effects of disasters
Friends of Arabuko Sokoke Forest;	Poverty and low education
Arabuko Sokoke Forest Management Team	Illiteracy and poor governance aids destructive practices.

In further analyses of the vulnerability, the researcher sought to find out –from the key informants –factors that influence the vulnerability level of the ASF adjacent community to disaster risks. The Table 4.22 shows that migration, weak awareness systems, lower level of education, poverty (factored by occupation and income) and weak awareness system are the main influence to the vulnerability level of the forest adjacent dwellers.

4.4 Policies and Practices to Disaster Risk Reduction

4.4.1 Policies and Practice of ASFADA Regarding Disaster Risk Reduction

This research sought to review the policy and practice of the forest adjacent dwellers as identified to have directly or indirectly have influence on disaster risk reduction. This was achieved through thematic analysis of data collected from the 3 principal representatives from the 3 CFAs that the study data was drawn.

Table 4.19 Policies and Practice of ASFADA on Threats

Factors	Policy	Practice
Logging (legal)	Afforestation	Seedling provision. Enlightenment on logging
Illegal logging	Loggers should have government license.	Report violators.
Poaching	No trading of dead or live animals from beyond the commercial zone from the community areas	Report animal trading beyond the commercial zone.
Forest encroachment	No violation of forest zoning system on land use	Report violators
NTFP exploitation	Non-sales of NTFP but for personal consumption and subsistence use.	Monitor and report violators Source for other agri-business means for members by partnership with NGOs
Mining	Mining is not very good since it has environmental effects	Miners should have government license and safety approval of the community
Agricultural malpractices	No farming on slopes among other practices that can cause bad effects	Education on indigenous farming practices to members
Property/farm destruction by animals	Fencing	Partner with NGOs for help

Table 4.19 above shows that the forest community has policy and practices that fits into the reduction of threats that affects the forest and the adjacent dwellers.

Table 4.20 shows various policies on ensuring the prevention of deforestation, forest fires, flooding, pollution, drought, famine, fuel/water crisis, and resource based conflict. And there were no specific guidelines regarding landside, desertification, and disease epidemic as further show in the table.

Table 4.20 Policies of ASFADA on DRR

Disaster	**Policy**
Deforestation	Afforestation. Report members that log illegally. Logging members should be government licensed. And adherence to the forest management zoning system.
Forest fires	No charcoal burning closer to bushy or heavily plant covered area especially during dry seasons. No bush burning for haunting or for bush clearing.
Landslide	None specifically.
Desertification	None specifically.
Flooding	Planting of cover crops. Avoid activities that interfere with water channeling system or drainage.
Pollution	Discourage tree burning. Discourage exploration that may cause harm to the community's environmental health.
Drought	Education on drought resistant crops, and planting them to ensure food security.
Famine	Support members with planting seedlings which helps to increase food security.
Disease epidemic	None specifically.
Fuel/water crisis	Water catchments should be protected. Obey the government zones regarding forest use.
Resource based conflict	Land owners should possess title deeds.

4.4.2 Policies and Practice of Forest Management Organizations on Threats

Table 4.21 below shows various DRR related policies and practices of organizations, among which are governmental institutions falling under the jurisdiction of GoK mandate towards ensuring forest management and sustainability forest management; NGOs which partner with the GoK and the forest communities for community developmental projects and forest sustenance; and CBOs that are indigenous to the ASF area. This study thus sought to capture the policies and practices of the above mentioned key stakeholders through interview guide conducted.

Table 4.21 DRR Related Policies and Practice of ASF Management Institutions

Institutions **(Policy)**	**Practices**
Ministry of Environment, Water and Natural Resources. **(Capacity building and awareness in conservation**)	Promotion of soil and water conservation programmes. Provision of coordinated extension services to help improve agricultural practices. MEWNR has helped in ensuring food security through the provision of safety services on agro-chemical and promotion of sustainable agro-practices. Also engaged in afforestation programmes in sustenance of the forest.
Kenya Forest Service **(Forest Physical and social security)**	Encouragement of community conservation. Development of resource sharing frameworks. Booked information regarding illegal forest practices to benchmark and further avail such information for further necessary judicial and investigative engagements. Providing security on logging, encroachment, and other forest exploitation. Expansion of tourist/eco-tourism to the adjacent community areas to enhance social belongingness of the community. Engaging the youths in government-community programmes/activities.

Kenya Forest Research Institute **(Conducts research in ASF areas; disseminate the findings; establish partnerships with other research institutions)**	Helped to develop the management plan of the ASF. Piloted the current PFM practice in ASF. Ongoing research projects in the ASF area are focused on forest productivity and improvement which captures pest and disease management; biodiversity and environment management which captures climate change and carbon studies; socio-economics and governance studies which captures PFM, forest extension, livelihood improvement and forest product marketing.
National Museum Kenya **(Aesthetic and monumental preservation)**	Promotion of conservation sites to prevent aesthetic hazards among other hazards.
Aroche Kenya **(conservation and community empowerment)**	Education/training on food security and farming practice and conservation. Environmental education to school teachers around the ASF on how to incorporate environmental studies on the pupil's curricular. Have set-up on-going educational programme called Arabuko-Sokoke Schools and Eco-tourism Scheme (ASSETS), and funded from eco-tourism arm of the organization. Also engage in conservation projects, and scientific research programmes. Have engaged the ASF youths through creation of volunteer job and which further create capacity development for the ASF community
Friends of Arabuko Sokoke Forest **(Community enlightenment and assistance)**	Sponsorship of scholarship programmes in ASF communities. Promotion of the interest of the community. Organize awareness campaigns on none-exploitation of forest products, hazards from mining and illegal practices. Also sensitization on conservation of the forest against oil exploration/drills. Solicits for micro-finance schemes/opportunities for the forest community.

4.4.3 Early Warning System (EWS) and just-after-Disaster Services Provided by Forest Actors

In Table 4.22, 73.3% of the respondent indicated that the CBOs/NGOs provided EWS in cases of disasters they have experienced, 6.7% indicated EWS was provided by the Government agencies, and 1.7% by both government, CBOs and NGOs. As indicated by the respondents, most of the EWS –signs about impending disaster and information about on-going disasters –were communicated either through social relationships among the community organization members or NGOs. This is an indication that the relevant government agencies have weak EWS organization, management and communication.

Table 4.22 Early Warning System (EWS)

Early Warning System	Arabuko Number of Response	Gede Number of Response	Sokoke Number of Response	Total Responses		Percent of Cases
				N	Percent	
Community based organisation; and non-governmental organization provided	14	20	10	44	41.9	73.3
Government provided	2	2	0	4	3.8	6.7
Government; community based organization; and non-governmental organization provided	0	0	1	1	1.0	1.7
No early warning system provided	11	23	22	56	53.3	93.3
Total	27	45	33	105	100.0	175.0

Table 4.23 shows that greater percentage –35.6% of respondents' responses –of personnel to respond were provided by the government agencies while –only 8.7% –

lower percentage were from CBO/NGOs. This indicated that the government relevant agencies more than averagely have personnel to respond to disasters as they occur while CBOs/NGOs have fewer personnel to respond. This can be attributive to the high non-pay/volunteer work that CBOs/NGOs operates-on, although they have fewer responds personnel but there is high tendency of work effectiveness as seen in CBO/NGO's EWS capacity.

Table 4.23 Personnel to Respond

Personnel to Respond	Arabuko Number of Response	Gede Number of Response	Sokoke Number of Response	Total Responses		Percent of Cases
				N	Percent	
Government provided	16	8	13	37	35.6	61.7
Government; community based organization; and non-governmental organization provided	6	4	7	17	16.3	28.3
Community based organisation; and non-governmental organization provided	0	8	1	9	8.7	15.0
No personnel to respond	5	25	11	41	39.4	68.3
Total	27	45	32	104	100.0	173.3

Out of the respondents' responses on personnel to respond, 16% of the response indicated that personnel to respond were joint operation of both the government and CBO/NGO. This shows that there is more joint effort to provide personnel in immediate scenarios of post disaster.

Table 4.24 shows that 26.7% of respondents' responses –about who provided resources to

Table 4.24 Resources to Respond

Relief Resources to respond	Arabuko Number of Response	Gede Number of Response	Sokoke Number of Response	Total Responses		Percent of Cases
				N	Percent	
Government provided	11	8	9	28	26.7	46.7
Government; community based organization; and non-governmental organization provided	9	4	11	24	22.9	40.0
Community based organisation; and non-governmental organization provided	1	11	4	16	15.2	26.7
No resources to respond	6	23	8	37	35.2	61.7
Total	27	46	32	105	100.0	175.0

reduce their impact from such disaster –indicated that the government provided them while 15.2% indicated it came from CBO/NGO. This indicates that the government agencies provide greater resources in post disaster phase. Also 22.9% responses highlights joint relief resources by the CBO/NGO, an indication of more increased joint effort of post disaster responds.

4.5 Role of Forest Actors in DRR

The research sought to question the respondents on their roles/activities within the forest and the adjacent areas; in order to establish the effects those roles plays toward the approach of disaster risk reduction. Below is analysis that addresses the opportunities and activates that have been created –and which have short or long term implications either positively or negatively to DRR.

Table 4.25 Access to Resources

Access	Arabuko Number of Response	Gede Number of Response	Sokoke Number of Response	Total Responses		Percent of Cases
				N	Percent	
Water	20.0	16	19.0	55	20.6	91.7
Funding	17.0	9	15.0	41	15.4	68.3
Firewood	10.0	16	15.0	41	15.4	68.3
medicinal plants	9.0	13	12.0	35	13.1	58.3
Grazing	7.0	12	12.0	31	11.6	51.7
Nuts/seeds	7.0	8	10.0	25	9.4	41.7
bee/honey	6.0	9	9.0	24	9.0	40.0
Gaming	4.0	4	1.0	9	3.4	15.0
eco-tourism	2.0	3	1.0	6	2.2	10.0
Total	82.0	90	95.0	267	100.0	445.0

Table 4.25 shows that respondents from Sokoke relatively have access to resources followed by Gede before Arabuko. Also larger percentages of the respondents have access to the following forest resources –water (91.7%), firewood (68.3%), medicinal plants (58.3%), grazing land (51.7%); slightly above one fifth –21.8% of the respondents' responses agree to having access to other agricultural activities like forest nuts/seeds, bee framing /honey harvesting, and gaming. Controlled access to forest' natural resources are vital in ensuring agricultural growth and productivity[130]. This is an indication of livelihood expansion, economic capacity building as a role towards reducing the risk of the community disturbance the forested zones, and also a long term effect on reducing food security.

Out of the 60 respondents, –68.3% greater percentage of the respondent have had access to receive financial support inform of loan or grants –through membership in their

[130] FAO. (2015). The impact of natural hazards and disasters on agriculture and food security and nutrition: A call for action to build resilient. p15. Retrieved 24 August 2015, from http://www.fao.org/3/a-i4434e.pdf

respective forest community associations –to support their businesses or livelihood. This translates into financial capacity roles towards poverty reduction which has correlative effects of DRR.

Lower percentage –10.0% of the respondent have access to eco-tourism, partly due to strict access pass-payment that is involved in entry into the government conservation zones.

Also the respondents that indicated to have access to the eco-tourism forest part are mainly those with the occupation as ASF tour guides –the employer, ASF tour guide association also own cottages inside the forest as an effort to enhancing eco-tourism.

Table 4.26 Benefits through Social Relationship with Forest Organisations

Benefit	Arabuko Number of Response	Gede Number of Response	Sokoke Number of Response	Frequency	Percent
yes, helped through project funding & skill acquisition	8.0	4.0	6.0	18.0	30.0
yes, helped through project funding	1.0	5.0	9.0	15.0	25.0
yes, helped through skill acquisition	5.0	2.0	3.0	10.0	16.7
No benefit	6.0	9.0	2.0	17.0	28.3
Total	20.0	20.0	20.0	60.0	100.0

Table 4.26 shows that Sokoke have greater social help in terms of funding and skills acquisition while Arabuko had the least benefits. Also 71.7% of the respondents have benefited from societal relationships directly or indirectly through social contact with NGOs/CBO organizations outside their respective ASF adjacent community dwellers association. This is believed to have effect on mental calmness as loneliness from the societal activities could also attribute to engagements in activities that could endanger the forest and it's environ. Those CBOs/NGOs have engaged the respondents either through

funding, or skill acquisition, or both as in capacity development.

Table 4.27 shows that 64.0% of the respondents have passed through capacity development in form of participation in trainings, attending scheme or community campaigns on how to improve and conserve the forest. 18.7% of the respondents have been employed through the emergence of the forest management approach, while 17.3% or the respondents have received child education scholarship or sponsorship.

Table 4.27 Capacity Development

Capacity development	Arabuko Number of Response	Gede Number of Response	Sokoke Number of Response	Responses		Percent of Cases
				N	Percent	
Employment	2	7	5	14	18.7	24.6
Child education and scholarship	7	3	3	13	17.3	22.8
Training and knowledge improvement on forest management/conservation	18	14	16	48	64.0	84.2
Total	27	24	24	75	100.0	131.6

4.6 Challenges to Disaster Risk Reduction in ASF area

The researcher sought to enquire from the respondents, the disaster risk reduction challenges that they are faced with in their various efforts to manage the forest. The respondent's multiple responds about the challenges were categorized into policy and practice challenges.

Table 4.23 shows the respondent's theme on the challenges of ensuring the disaster risk reduction in policies and practices of PFM. Out of the respondents' response on DRR challenge factors to the ASF area 52.5% indicated policy challenge –most from Arabuko area, while 48.3% indicated practice challenge most of which are experienced in Sokoke.

Table 4.28 Policy and Practice Challenges to DRR

Challenges			Arabuko Number of Response	Gede Number of Response	Sokoke Number of Response	Total Responses		Percent of Cases
						N	Percent	
Policy	1	weak institutional capacity/enforcement of laws	20.0	19.0	19.0	58.0	30.2	96.7
	2	weak early warning system	16.0	7.0	8.0	31.0	16.1	51.7
	3	weak hazard assessment	7.0	1.0	4.0	12.0	6.2	20.0
Practices	1	Stop forest exploitation.	10.0	17.0	17.0	44.0	22.9	73.3
	2	encourage hazard drills/exercise, community training on early warning systems & safe forest harvesting	15.0	7.0	13.0	35.0	18.2	58.3
	3	Expansion of livelihood sources.	5.0	2.0	5.0	12.0	6.2	20.0
Total			73	53.0	66	192.0	100.0	320.0

4.6.1 Policy Challenges to DRR

Out of the total responds, 96.7% of the respondents identified weak institutional capacity and enforcements of laws, 51.7% on weak early warning system, 20.0% of the respondent agreed to weak hazard assessment.

Weak institutional capacity increases disaster risks due to weak hazards and vulnerability reduction[131]. The institutionalized capacity as identified by the respondents stressed poor

[131] APN. 2005. Institutional Capacity in Natural Disaster Risk Reduction: A Comparative Analysis of Institutions, National Policies, and Cooperative Responses to Floods in Asia. Asia-Pacific Network for Global Change Research. ; World Bank. 2010. Report on the status of Disaster Risk Reductionin Sub-Saharan Africa. World Bank Press.

governance which leads to the followings: poverty which increases vulnerability and forest disturbance; corruption which has led to over-logging and legal logging; lack of community training on disaster management; poor personnel-responds in times of disaster; and poor disaster-theme linkage of agencies. The weak warning capacity as stressed by the respondent is the lack of institutionalized warning detection and communication to enhance actionable activities that are proportionate to reducing vulnerability. The hazard

assessment as identified by the respondents are weak monitoring and evaluation of threats, this agrees with the respondents' low awareness about secondary impacts of deforestation as shown in –Table 4.9 –where the respondents did not identify impacts from deforestation.

4.6.2 Practice Challenges to DRR

Out of the respondent's responses on practice challenges, 73.3% of the respondents identified forest exploitation as practices that should be stopped; 58.3% of the respondents identified the need for hazard drills/exercises, community training on early warning systems and safe forest harvesting; and 20.0% of the respondents agrees to the expansion of livelihood sources.

Sustainable forest management discourages forest exploitation[132], and has effects on hazards and vulnerability reduction.[133] The forest exploitation as identified by the respondents includes: discouragement of oil drilling and mining, discouragement of tree cutting and encouragement of tree planting, and anti-poaching practices.

[132] John Twigg. 2009. Characteristics of a Disaster Resilient Community: A GUIDANCE NOTE Version 2. University College, London. Retrieved 24 August 2015, from http://www.abuhrc.org/research/dsm/Pages/project_view.aspx?project=13

[133] Stephan Baassel., Varaju Ramasamy., Jenny Dey Depryck Federica Battista,. (2008). Institutions For Disaster risk Management Disaster Risk Management systems Analysis: FAO, Environment, Climate Change and Bioenergy Division. Retrieved 24 August 2015, from ftp://ftp.fao.org/docrep/fao/010/ai504e/ai504e00.pdf

Disaster training and awareness through direct education, drills and exercises reduces disaster risks[134]. The indicates challenge in the second category which pooled response – identified by the respondents as disaster related community trainings; and good cultivation practices, protection of water sources and drainage systems to reduce flooding, and discouragement of illegal forest product sales.

[134] Bishnu Pandey and Kenji Okazaki. Community Based Disaster Management: Empowering Communities to Cope with Disaster Risks. United Nations Centre for Regional Development, Japan. Retrieved 24 August 2015, from http://unpan1.un.org/intradoc/groups/public/documents/UN/UNPAN020698.pdf

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0. Introduction

This chapter presents the summary of major findings, conclusions, and recommendations. The broad objective was to examine disaster risk reduction linkage with participatory forest management in Arabuko Sokoke forest. The study further sought to achieve the following specific objectives: examine the hazards and vulnerability in Arabuko Sokoke forest; to review participatory forest management policies and practices related to disaster risk reduction; to establish the role of participatory forest management actors in disaster risk reduction within the Arabuko Sokoke forest; to examine the challenges faced in disaster risk reduction policy and practices in forest management.

5.1. Summary of Key Findings

The study found out that the major anthropogenic activities that can influence disaster risks in the ASF areas are logging legal over-logging or illegal logging, poaching, forest encroachment while agricultural malpractices, farm and property destruction, and over harvesting of non-timber forest products are lesser threat to influencing disaster risks. The disaster risks which can be influenced by those threats are deforestation, forest fires, flood, drought and resources based conflict with at least most of them occurring in within a period of 2 to 3 years but exclusive to deforestation that is gradual and continuous. The impact of deforestation was its implications on secondary effects from primary disaster impacts like while the food security through damage to farms, crops, and water sources; effects on livelihood through property and house damages.

On the vulnerability level, the study found a lower level of income and educational level with more than half of the respondents engaged in unskilled labour, although the mean household size of 5 members is of great advantage to quick disaster evacuation, search and rescue. There were lower levels of awareness systems, moderate level of early warning system, and higher personnel to respond and resources provision in cases of

disasters. Corruption through poor governance and migration closer to the forested zones has also influenced the vulnerability level of the forest adjacent dwellers.

In line with objective two and research question two, the adjacent dwellers forest associations to which the respondents belong through membership –have engaged with good policies and practices on awareness, education, and membership-support to improve livelihood and provisions to monitor threats and the possible disaster risk to the forest and the adjacent dwellers. The Ministry of Environment, Water and Natural Resources, Kenya Forest Service, Kenya Forest Research Institute, and National Museum Kenya all stressed on forest physical and social security through conservation programs; eco-tourism enhancement; scientific research programmes on better forest management and governance; agro related extension and practices promotion. The NGOs focused of food security, community environmental protection training and programmes, research and skill acquisition programs.

The general policy and practices of all the forest management actors includes themes of anti-logging; adherence to forest zoning of forest resource utilization; community empowerment through educational, financial, and developmental projects; and awareness programs on forest sustainability.

Awareness and early warning systems are important factors in risk reduction[135], this research found that greater reactionary strategy of personnel/resources to respond in the ASF areas, but weak proactive strategy like awareness and early warning system. In practical responds to pre and post disaster conditions, of the lower percentage of warning systems as identified by the respondent's responses of 29.8% out of 100%, the governments' agencies provided only 3.8% while the community based organizations and NGOs filled the gap. An important point is that the level of cooperation between government agencies and CBOs/NGOs in early warning systems is weak.

[135] WHO. 2007. Risk reduction and emergency preparedness: WHO six-year strategy for the health sector and community capacity development. World Health Organisation Press. Geneva, Switzerland.

The means of early warning systems in-place –non-government provided warning systems –through words by social groups, and non-empirically derived signs of impending drought or flooding –are not sophisticated enough as compared to if such system were operated by highly equipped and designated agency. In post disaster events the governments' agencies have provided the majority of personnel and resources to respond and with increased level of cooperation with the CBOs/NGOs from personnel-to-respond to resources-to-respond. In terms of resources to respond, the government agencies had a higher status compared to the CBOs/NGOs this could be attributed to non-governmental funding and sponsorships of governmental programmes/projects which operationalized by the physical face of the government agencies without the physical identification of the funders.

With regards to the objective three and research question three, the study found that respondents have access to forest products and greater access to funding which have positive effect on management role towards poverty reduction, over dependence on illegal harvesting of forest products which degrades the forests, and also and aid to expansion of livelihood means. There are greater accesses in the areas of social networking and capacity developments in terms of social belongingness in beneficial groups and knowledge improvement. However there are support through employment and child education sponsorship but those supports are far below average.

In line with objective four and research question four, the study found that there are almost equal levels of imbalances between policy and practice challenges. The following summates the policy challenges: weak institutional capacity to deal with poverty, forest disturbance, and appropriate linkages between disaster management institutions; weak early warning capacity to deal with institutionalized warning detection and communications; and hazards assessment with respect to identifying, monitoring and evolution of deforestation threats. Forest exploitation either through search for oil reserves or degradation by the populace; and lack of practical community hazards training were the major challenges to the forest management practices along with the need to expand livelihood sources of the adjacent dwellers.

5.2. Conclusions

Extensively large numbers of poor and dependent people found around the forest usually mismanage the forest[136], and also poverty and low education affects food security as a result of the increased natural disasters from the widespread human intervention in the climatic systems though the forest[137]. Poverty and low education as factors that increases forest disturbance in Kenya[138] and are not exclusive to ASF area. The study found majority of the ASF adjacent dwellers are living below the minimum wage poverty line and lower educational levels, which increases the frequency of anthropogenic activities like logging, encroachment, poaching among other forest malpractices that increases the vulnerability to risks of disasters that are related to food insecurity and livelihood loss/suppression.

The study found that there are provisions by the community and non-governmental forest management organizations, and government forest management institutions, geared towards enhancing economic capacity in terms of building capacities to reduce over dependence and reliance on illegal livelihood sources by granting the adjacent communities access to non-timber forest products. Also in areas of capacity development, those organizations have engaged –but in weaker capacity –the adjacent dwellers to employment, child education sponsorships and training scheme to improve the community's knowledge on the importance of forest conservation. Other areas of engagements are increasing financial capacity to alleviate poverty through enabled loans/grants, and increasing the social capacity of societal belongingness of the forest adjacent communities.

[136] Byron, N. and Arnold, M. (1999) What Futures for the People of the Tropical Forests? World Development, 27, 789- 805.

[137] Sven Wunder. 2001. Poverty Alleviation and Tropical Forests: What Scope for Synergies? Center for International Forestry Research (CIFOR), Jakarta, Indonesia. World Development Vol. 29, No. 11. ; and IPCC. 2001. Climate change 2001: the scientific basis. Third Assessment Report. Retrieved 24 August 2015, from http://www.grida.no/climate/ipcc_tar/wg1/pdf/wg1_tar-front.pdf

[138] Paul M. Guthiga, John Mburu, Karin Holm-Mueller. 2008. Factors Influencing Local Communities' Satisfaction Levels with Different Forest Management Approaches of Kakamega Forest, Kenya. Springer Science+Business Media, LLC. 25 August 2015, from http://link.springer.com/article/10.1007/s00267-008-9080-z#page-1

Access to resources including information, knowledge, and technology; limited access to political power and representation; social capital, including social networks and connections, decreases risks to DRR[139]. And early warning is a major element of disaster risk reduction. It saves life and reduces economic and material losses from disasters[140].

However, this is averagely the case in ASF areas as there are weak direct disaster linkages as there were no early warning systems in most cases of pre-disaster phases, and in cases where there were warning systems, the mechanism of the warning system is weaker in aspects of better communication and authenticated information that can be followed by actionable reactions.

The disaster risk management systems are still centralisezed in Kenya and thus gives great limitation for governmental institutions while the NGOs tries to feel the void.[141] A challenge of weak incorporation of warning system, hazards assessment and improvement of designated agencies on disaster risk management around the forested area is of great concern. This was stress in form of limitation to this research study where the National Disaster Operation Centre could not be interviewed as one of the key informants due to the centralized disaster management operation policy with no linking data and information with ASF forested areas. Also weak capacity to deal with governance and corruption has increased forest exploitations with lower level of concrete disaster incorporated approaches in the forest management practices.

The Weak DRR capacities implementation as identified by this study, resulted from the weak institutional capacity as the effects from the weak policy implementation of the 5 HFA priorities within the ASF on DRR captioned to ensure that DRR is a national and local priority with a strong institutional basis for implementation; Identify, assess and monitor disaster risks and enhance early warning; Use knowledge, innovation and

[139] Cutter, (2001a), Op.cit ; Tierney, Lindell, and Perry,(2001), Op.cit; Putnam, (2000), Op.cit; Blaikie et al., (1994). Op.cit

[140] Mercy Corps. 2010. Establishing Community Based Early Warning System: Practitioner's Handbook. Mercy Corps and Practical Action 2010

[141] Vincent Matioli. 2015. National progress report on the implementation of the Hyogo Framework for Action (2013-2015). Retrieved 25 August 2015, from http://www.preventionweb.net/files/42432_KEN_NationalHFAprogress_2013-15.pdf

education to build a culture of safety and resilience at all levels; Reduce the underlying risk factor; and Strengthen disaster preparedness for effective response at all levels[142].

5.3 Recommendations

Based on the findings above, on the linkage between disaster risk reduction and participatory forest management, the following recommendations were made:

There should be national policy regarding forest management which incorporates conducting hazards and vulnerability assessments in order to ensure policy driven programmes that are directed towards threats management like hazards monitoring and communication; and expansion of livelihood sources of the community to reduce poverty.

Creation of special funding system to designated agencies on enhancement of early warning systems and subsequently awareness creation is important as a pro-active policy on disaster risk reduction. Also policies regarding strict adherence to institutional mandates should be promoted in order to arrest the leakages through funds misappropriation and illegal approval of degenerative forest practices especially in the case of corruption as strongly recommended by the respondents and the key informants.

Improvement of designated disaster management organizations with regards to proactive disaster management approaches through greater vulnerability reduction and increased capacity development. Policy implementation is recommended in areas of apprehension of violators and legal prosecution of forest conservation rules/standards breakers, and increased effort of the designated anti-corruption agencies to track officers that aid forest exploitation. This is in light with the respondents and key informant's challenge theme of the correlation between corruption and logging.

[142] UNDP. 2011. Crisis Prevention and Recovery: Strengthening Capacities for Disaster Risk Reduction A Primer. United Nations Development ProgrammeRegional Crisis Prevention and Recovery Programme. Retrieved 25 August 2015, from http://www.preventionweb.net/files/globalplatform/entry_bg_paper~strengtheningcapacityfordrraprimerfullreport.pdf

Delineated roles to specified agencies with respect to monitoring warnings, communication of warnings and awareness about those warnings, all geared toward pro-action measures to improve the early warning systems.

The disaster risk management in Kenya is still limited to non-multi sectoral approach[143], since food security is the critical theme for disaster impacts in ASF areas –identified from the Table 4.4, thus it is of critical importance to adopt multi-sectoral of resilience in agriculture for food security and nutrition, some countries have started to adopt clear policies to mainstream disaster risk reduction across key sectors[144]. The decentralization of the National Disaster Operation Centre office –with established linkage to all forest agencies and –devolution from Nairobi to the rest of the Counties and districts is highly recommended, to areas like Kilifi to enable and facilitate proper disaster data collection, communication and risk managements.

5.4 Areas for Further Research

This study established linkages between disaster risk reduction and participatory forest management but recommend strong reinforcement of the linkages. And thus suggests researches to be conducted in areas with themes as environmental impact assessment of disasters in forest areas, recovery strategy in post disasters among the forested communities, early warning systems strategies to reduce environmental disaster risk, effects of non-participatory forest management model on disaster risk reduction.

[143] Ibid

[144] FAO. (2015). The impact of natural hazards and disasters on agriculture and food security and nutrition: A call for action to build resilient. p15. Retrieved 24 August 2015, from http://www.fao.org/3/a-i4434e.pdf

REFERENCES

APN, (2005). Institutional Capacity in Natural Disaster Risk Reduction: A Comparative Analysis of Institutions, National Policies, and Cooperative Responses to Floods in Asia. Asia-Pacific Network for Global Change Research.

Arnstein, Sherry R (1969) 'A Ladder of Citizen Participation' in Journal of the American Planning Association , Vol. 35, No. 4, July, pp. 216-224

ASFMT, (2002). Arabuko-Sokoke Strategic Forest Management Plan, 2002-2027. Forest Department, Nairobi Kenya and BirdLife Int, Cambidge

Bankoff, G. (2003). Cultures of Disaster: Society and natural hazards in the Philippines. London, Routledge Curzon

Barrow E, Murphree MW. (2001). Community Conservation: From concept to practice. In *African Wildlife and Livelihoods: The promise and performance of community conservation*, Hulme D, Murphree MW (eds.). James Currey: Oxford, UK; 24-37

BirdLife, International, (2003). BirdLife's online world bird database for bird conservation. Version 2.0 BirdLife International, Cambridge, United Kingdom. http:www.birdlife.org

Bishnu Pandey and Kenji Okazaki. Community Based Disaster Management: Empowering Communities to Cope with Disaster Risks. United Nations Centre for Regional Development, Japan. Retrieved 24 August 2015, from http://unpan1.un.org/intradoc/groups/public/documents/UN/UNPAN020698.pdf

Blaikie, P., T. Cannon, I. Davis, and Wisner, B. (1994). At Risk: Natural Hazards, People's Vulnerability, and Disasters. London: Routledge.

Blomley, T., Pfliegner, K., Isango, J., Zahabu, E., Ahrends, A. & Burgess, N.D. (2008) Seeing the wood for the trees: an assessment of the impact of participatory forest management on forest condition in Tanzania. *Oryx* **42**: 1–12.

Burke E.J., Brown S.J., and Christidis N. (2006). "Modelling the recent evolution of global drought and projections for the 21st century with the Hadley Centre climate model", Journal of Hydrometeorology 7(5), 1113–1125.

Burns, D et al (1994) The politics of decentralisation, London: Macmillan

Bussmann, R.W, (2006). Vegetation zonation and nomenclature of African mountains – An overview. Lyonia Journal of Ecological Application, 11: 41-66

Byron, N. and Arnold, M. (1999) What Futures for the People of the Tropical Forests? World Development, 27, 789- 805.

CAG Consultant. Participation: *A theoretical context*. Retrieved 5 February 2015, from http://webcache.googleusercontent.com/search?q=cache:pEp4qBkYPMwJ:www.cagconsultants.co.u

Center for International Forestry Research (CIFOR), Jakarta, Indonesia. World Development Vol. 29, No. 11.

Cutter S. L, (Ed.) (2001a). American Hazardscapes: The Regionalization of Hazards and Disasters. Washington DC: Joseph Henry Press.

Cutter, S. L., J. T. Mitchell, and M. S. Scott., (2000). ‘‘Revealing the Vulnerability of People and Places: A Case Study of Georgetown County, South Carolina.’’ Annals of the Association of American Geographers 90(4):713–37.

Decision 1/CP.16. (2010). The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention, para 70. p12 Retrieved 13 March 2015, from http://unfccc.int/resource/docs/2010/cop16/eng/0

Dilley, M., Chen, R.S., Deichmann, U., Lerner-Lam, A., Arnold, M., (2005). Natural Disaster Hotspots. A Global Risk Analysis. The World Bank, Hazard Management Unit, Washington, DC.

Dilys Roe, Fred Nelson and Chris Sandbrook.. CMNR in Africa: *Impacts, experiences and future directions* pp28

Donald A. M., and Jo-Ansie van Wyk., (2010). Climate Change and Natural Resources Conflicts in Africa. Retrieved 25 August 2015, from https://www.issafrica.org/uploads/Mono170.pdf

DRSRS and KFWG, (2006). Changes in Forest Cover in Kenya’s Five Water Towers, 2003-2005. Department of Resource Surveys and Remote sensing and Kenya Forests Working Group.

Edmund Barrow, Helen Gichohi, and Mark Infield, (2000). Rhetoric or Reality? *A Review of Community Conservation Policy and Practice in East Africa.* Pp95

FAO, (2001), Global forest resources assessment 2000, FAO Forestry Paper 140, FAO, Rome

FAO, (2003), Sustainable forest management and the ecosystem approach: two concepts, one goal. Wilkie M.L., Holmgren P., Castaneda F. FAO Working Paper FM 25. Forest Resource Department, Forest Resource Division, FAO Rome. p6 Retrieved 17 March 2015, from http://www.fao.org/forestry/6417-0905522127db12a324c6991d0a53571fa.pdf

FAO, (2003b). FOSA: Sub-regional Report, East Africa. FAO, Rome. 54 p.

FAO, (2006a). Report of the expert consultation on Global Forest Resources Assessment: Towards FRA 2010, 12–16 June 2006, Kotka, Finland. Rome, Italy. (Also available at http://www.fao.org/forestry/11187-1-0.pdf)

FAO, (2010): Forest Resources Assessment Report.

FAO, (2015). The impact of natural hazards and disasters on agriculture and food security and nutrition: A call for action to build resilient. p15. Retrieved 24 August 2015, from http://www.fao.org/3/a-i4434e.pdf

FAO, (2015). The impact of natural hazards and disasters on agriculture and food security and nutrition: A call for action to build resilient. p15. Retrieved 24 August 2015, from http://www.fao.org/3/a-i4434e.pdf

FAO, (2015). Voluntary REDD+ Database. Retrieved 13 March 2015, from http://www.fao.org/forestry/vrd/entities/114#arrangements/q//t/2009-2016/f/all/r/all/a/0-12/p/1

FEFRI, (2009). Community Forest Associations in Kenya: *challenges and opportunities* by C. K. Koech, P. O. Ongugo, M. T. E. Mbuvi and J.O. Maua, 2009.

FoASF, (2015). *Friends of Arabuko Sokoke Forest – David Ngala*. Retrieved 28 January 2015, from http://davidngala.wildlifedirect.org/tag/friends-of-arabuko-sokoke-forest/

Frankenberg, E., B. Sikoki, C. Sumantri, W. Suriastini, and D. Thomas., (2013). Education, vulnerability, and resilience after a natural disaster. Ecology and Society 18(2): 16. http://dx.doi.org/10.5751/ES-05377-180216

Garrett Nagle, (1999). Britain's Changing Environment: *Focus on geography*. Illustrated Edition, Nelson Thornes Publisher

GoK, (1968). *A Forestry Policy for Kenya.* Nairobi, Government Printer. Session Paper No.1 of 1968.

GoK, (2005). Kenya Forest Act 2005.

GoK, (2009). Draft National Policy for Disaster Management in Kenya. p15,p20 Retrieved 17 March 2015, from http://www.ifrc.org/docs/idrl/765EN.pdf

GOK/MEMR, (2010) National Climate Change Response Strategy: Executive Brief; Ministry of Environment and Mineral Resources, April 2010. p4

Goldammer J.G. and de Ronde C. (eds) (2004). Wildland Fire Management Handbook for sub-Sahara Africa. Global Fire Monitoring Centre (GFMC), Freiburg.

Guardian, (2012). Environment –Guardian weekly outlook on international development: *Conservation is priceless for Kenyan* forest by Daniel Sitole. Tuesday 21 February 2012 13.59 GMT http://www.theguardian.com/society/2012/feb/21/arabuko-sokoke-kenya-forest-conservation

Heinz Center for Science, Economics, and the Environment, (2000). The Hidden Costs of Coastal Hazards: Implications for Risk Assessment and Mitigation. Covello, Cal.: Island Press.

Helsinki, (2011). Strategy Note for Forest Governance Reform in Kenya. Final Draft by: Tapani Oksanen, Michael Gachanja and Anni Blåsten, Indufor for the "Miti Mingi Maisha Bora – Support to Forest Sector Reform in Kenya" (MMMB) Programme.

Hewitt, K., (1997). Regions of Risk: A Geographical Introduction to Disasters. Essex, U.K.: Longman.

Houghton R A, (2005), Tropical deforestation as a source of greenhouse gas emissions. In: Moutinho P and Schwartzman S (eds), 2005, Tropical Deforestation and Climate Change, Instituto de Pesquisa Ambiental da Amazônia, Belém, Pará, Brazil, pp13-21.

IPCC, (2001). Climate change 2001: the scientific basis. Third Assessment Report. Retrieved 24 August 2015, from http://www.grida.no/climate/ipcc_tar/wg1/pdf/wg1_tar-front.pdf

ISDR (2004) Living with Risk: A global review of disaster reduction initiatives, UN/ISDR, Geneva, Switzerland

ISDR, (2008). Report on the Status of Disaster Risk Reduction in the Sub-Saharan Africa Region. p4, 37

ISDR, (2008). Report on the Status of Disaster Risk Reduction in the Sub-Saharan Africa Region.

IUCN 1996. Forest cover and forest reserves in Kenya: policy and practice. Nairobi, IUCN. IUCN Eastern Africa Programme, *Issues in Conservation*: 24.

John R. "Bob" Bridge. (2010) Mitigating Wildfire Disaster: Early Detection and Commitment - Disaster Recovery Journal - Dedicated to Business Continuity. Retrieved March 16, 2015, from www.drj.com/articles/online-exclusive/mitigating-wildfire-disaster-early-detection-and-commitment.html

John Twigg, (2009). Characteristics of a Disaster Resilient Community: A GUIDANCE NOTE Version 2. University College, London. Retrieved 24 August 2015, from http://www.abuhrc.org/research/dsm/Pages/project_view.aspx?project=13

Jones B, Murphree MW. (2004). CBNRM as a conservation mechanism: Lessons and directions. In *Parks in Transition: Rural Development, Biodiversity and the Bottom Line*, Child B (ed.). Earthscan: London, UK; 63-104

KFS & MEWNR, (2007). Forest Law Enforcement and Governance in Kenya: *A paper prepared for the East African Community-led regional process in the framework of the Ministerial Declaration, Yaoundé, Cameroon, October 16, 2003 on the Africa Forest Law Enforcement and Governance (AFLEG)*

Kilifi County, (2015). Kilifi Secondary Data Review As At February 2014 Introduction Summary. Retrieved 17 August 2015, from http://webcache.googleusercontent.com/search?q=cache:cBSOth5IF4kJ:https://www.hum

Lanly J P, (2003), Deforestation and forest degradation factors, Paper to World Forestry Congress XII, Quebec City, Canada. http://www.fao.org/DOCREP/ARTICLE/WFC/XII/MS12A-E.HTM

Loita Naimina Enkiyia Conservation Trust Company (1994a). *Forest of the Lost child - Entim e Naimina enkiyio: A Maasai conservation success threatened by greed.* Nairobi, Kenya

Loita Naimina Enkiyia Conservation Trust Company (1994b). Statement by the Loita Naimina enkiyia Conservation Trust to the second session on the Intergovernmental committee on the Convention of Biodiversity. *Forest , Trees and People Newsletter* 25: 45.

Lutz, W., and K. C. Samir. (2011). Global human capital: integrating education and population. Science 333:587–592.

Matiku, P., C. Mireri, and C. Ogol. (2011b). Participatory natural resource management-policy and institutional framework (Part 1). *Environmental Policy and Law* 41(4-5): 232-239. pp115

McGuire, B., Mason, I., & Kilburn, C. (2002). Natural Hazards and Environmental Change.New York, NY: Oxford University Press.

Mercy Corps, (2010). Establishing Community Based Early Warning System: Practitioner's Handbook. Mercy Corps and Practical Action 2010

MEWNR, (2014). *Ministry of Environment, Water and Natural Resources:* Forest policy 2014. GoK

Murshed, Z. Bangkok, (2006). Community-Based Disaster Risk Management for Local Authorities: *Participants Workbook.* Asian Disaster Preparedness Centre (ADPC).

Mywage, (2015). Minimum Wage, Salary, Domestic Work in Kenya. Retrieved 17 August 2015, from http://www.mywage.org/kenya/home/salary

Nurse, M.C. & Edwards, S.R. (1993). Strategies for Sustainable Conservation of Forests Under Threat from their Adjacent Communities. KIFCON Kenya and Birdlife International.

Ochieng, E.,Giri, C.P., Tieszen, L.L., Zhu, Z., Singh, A., Loveland, T.R., and Duke, N., (2010), Ecosystem goods and services and the status and distribution of mangrove forest of the world [abs.], in ACES—A Community on Ecosystem Services, Gila River Indian Community, Phoenix, Ariz., 6-9 December 2010, Abstract Book: U.S. Geological Survey and the Institute of Food and Agricultural Sciences, University of Florida, p. 84.

One Green Planet, (2015). *Oil Exploration Threatens Kenya's Arabuko Sokoke National Forest and its Animals*. Retrieved 28 January 2015, from http://www.onegreenplanet.org/animalsandnature/oil-exploration-threatens-kenyas-arabuko-sokoke-national-forest-and-its-animals/

Ongugo, P.O and J.W. Njuguna. (2004). The Potential Effects of Decentralization Reforms on the Conditions of Kenya's Forest Resources. Paper presented to the Biennial Conference of the International Association for the Study of Common Property (IASCP) on 3-13th August, 2004. Oaxaca, Mexico

Ongugo, P.O., M.T.E. Mbuvi, J.O. Maua, C.K. Koech and R.A. Othim. (2007). Emerging Community Institutions for PFM process Implementation in Kenya. Paper presented to the 3rd International PFM Conference. Addis Ababa, Ethiopia..

Ongugo, Paul O. (2007): Participatory Forest Management in Kenya: Is There Anything for the Poor?, Proceedings: International Conference on Poverty Reduction and Forests, Bangkok, September 2007

Ostrom E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*, Cambridge University Press.

Ouma H. and Maina B.N. (2010) Vision 2030, social pillar gender analysis. In Society for International Development, p. 72–138

Patrick Van Laake, (2012). Kenya Advances its REDD+ Readiness Roadmap: *Features & Commentary UN-REDD Newsletter 31 -- Kenya Readiness Roadmap*. Retrieved 17 March 2015, from http://www.un-redd.org/Newsletter31/Kenya_Readiness_Roadma

Paul M. Guthiga, John Mburu, Karin Holm-Mueller. (2008). Factors Influencing Local Communities' Satisfaction Levels with Different Forest Management Approaches of Kakamega Forest, Kenya. Springer Science+Business Media, LLC. 25 August 2015, from http://link.springer.com/article/10.1007/s00267-008-9080-z#page-1

Peacock, W., B. H. Morrow, and H. Gladwin, eds., (1997). Hurricane Andrew and the Reshaping of Miami: Ethnicity, Gender, and the Socio-Political Ecology of Disasters. Gainesville, Fla.: University Press of Florida.

Persha, L. & Blomley, T. (2009) Management decentralization and montane forest conditions in Tanzania. *Conservation Biology* **23**: 1485–1496.

Peter Wass (2002). Kenya's Forest Resource Assessment: *Data Collection and Analysis for Sustainable Forest Management in ACP Countries - Linking National and International Efforts.* p13

Platt, R., (1995). ''Lifelines: An Emergency Management Priority for the United States in the 1990s.'' Disasters 15:172–76.

Porat, K.L.(1991).Women in administration: The difference is positive.Clearing House, 64(6), 412-415. www.wpnet.com/cgi-bin/epwtop/page

Puente, S., (1999). ''Social Vulnerability to Disaster in Mexico City.'' Pp. 295–334 in J. K. Mitchell, ed., Crucibles of Hazard: Mega-Cities and Disasters in Transition. Tokyo: United Nations University Press.

Richard, Hilderman. (2010) The Effect of Deforestation on the Climate and Environment – Understanding Climate Change Blog - MOTHER EARTH NEWS. Retrieved March 16, 2015, from www.motherearthnews.com/nature-and-environment/the-effect-of-deforestation-on-the-climate-and-environment.aspx

ROOTS, (2011). ROOT9: *Reducing risk of disaster in our communities* by Bob Hansford , Helen Gaw, Wingfinger. ROOTS: Resourcing Organisations with Opportunities for Transformation and Sharing. Tearfund, England, 2nd Edition. Retrieved 5 February 2015, from Web: roots pp 18-22

Samantha Marshall, (2011). The Water Crisis in Kenya: Causes, Effects and Solutions. Global Majority E-Journal, Vol. 2, No. 1 (June 2011), pp. 31-45

Sheila Reed, (1997). *Introduction to Hazards*, 3rd edition. InterWorks for DHA Disaster Management Training Programme. In collaboration with the University of Wisconsin-Disaster Management Center and InterWorks.

Stephan Baasselvaraju Ramasamyjenny Dey Depryckfederica Battista, (2008). Institutions For Disasterrisk Management Disaster Risk Management systems Analysis: FAO, Environment, Climate Change and Bioenergy Division. Retrieved 24 August 2015, from ftp://ftp.fao.org/docrep/fao/010/ai504e/ai504e00.pdf

Strauss, J., and D. Thomas. (2008). Health over the life course. Pages 3375–3474 in T. P. Schultz and J. Strauss, editors. Handbook of development economics, Volume 4. North-Holland Biomedical Press, Amsterdam, The Netherlands.

Sven Wunder, (2001). Poverty Alleviation and Tropical Forests: What Scope for Synergies?

Thomas, D. S. K., & Mitchell, J. T. (2001). Which are the most hazardous states? In American Hazardscapes: The Regionalization of Hazards and Disasters. Chapter 6. Washington DC: Joseph Henry Press.

Tierney, Lindell, and Perry, (2001)

Timberlake, L. (1994). *Africa in crisis: The causes, the cures of environmental bankruptcy.* East African Educational Publishers, Nairobi.

TNAU, (2014). Major Areas: Disaster Management: Forest Fire. Retrieved March 16, 2015, from www.agritech.tnau.ac.in/agriculture/agri_majorareas_disastermgt_forestfire.html

UN/ISDR, (2002). Living with risk: A global review of disaster reduction initiatives. The Secretariat of the International Strategy for Disaster Reduction (UN/ISDR), United Nations, Geneva, Switzerland, 382 pp. (http://www.unisdr.org)

UN/ISDR, (2003). Disaster Reduction and Sustainable Development: Understanding the links between vulnerability and risk to disasters related to development and environment United Nations/International Strategy for Disaster Reduction Disaster.

UN/ISDR, (2007). Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters. pp5-10 Retrieved 17 March 2015, from http://www.unisdr.org/files/1037_hyogoframewo

UNDP, (2004). Kenyan Natural Disaster Profile: in *Factors contributing to drought severity in Kenya*. p9

UNDP, (2011). Crisis Prevention and Recovery: Strengthening Capacities for Disaster Risk Reduction A Primer. United Nations Development ProgrammeRegional Crisis Prevention and Recovery Programme. Retrieved 25 August 2015, from http://www.preventionweb.net/files/globalplatform/entry_bg_paper~strengtheningcapacityfordrrapprimerfullreport.pdf

UNEP, (2005b). 'Environmental Management and Disaster Preparedness: Lessons Learned from Tokage Typhoon of Japan' UNEP: Osaka.

UNEP, (2009). "Kenya: Atlas of Our Changing Environment." Division of Early Warning and Assessment (DEWA) United Nations Environment Programme (UNEP) P.O. Box 30552 Nairobi 00100, Kenya

UNEP, (2015). Nairobi Convention: Contracting Parties. Kenya. http://www.unep.org/NairobiConvention/The_Co

UNICEF, (2006). http://www.unicef.org.uk/emergency/

Van der Wink, G., Allen, R.M., Chap?n, J., Crooks, M., Fraley, W., Krantz, J., Lavigne, A.M., LeCuyer, A., MacColl, E.K., Morgan, W.J., Ries, B., Robinson, E., Rodriquez, K., Smith, M., & Sponberg, K (1998). Why the United States is becoming more vulnerable to natural disasters". EOS, Transactions, American Geophysical Union, 79(44), 533-537.

Vincent Matioli, (2015). National progress report on the implementation of the Hyogo Framework for Action (2013-2015). Retrieved 25 August 2015, from http://www.preventionweb.net/files/42432_KEN_NationalHFAprogress_2013-15.pdf

Wafula Luasi Nabutola, (2012). The Challenges and Opportunities for Integrated Disasters and Risk Management with Particular Reference to Policy, Legislation and Regulations in Kenya. *8 th FIG Regional Conference 2012 Surveying towards Sustainable Development Montevideo*. p4 Retrieved 17 March 2015, from http://www.fig.net/pub/uruguay/papers/ts07a/TS07A_

Webb P., Braun J., and Teklu T. (1991). “Drought and famine in Ethiopia and Sudan: An ongoing tragedy”, Natural Hazards 4(1), 85–86

Western D, Russell S, Mutu K. 2006. *The status of wildlife in Kenya’s protected and non-protected areas,* Kenya’s Wildlife Policy Review Team.

WHO. (2007). Risk reduction and emergency preparedness : WHO six-year strategy for the health sector andcommunity capacity development. World Health Organisation Press. Geneva, Switzerland.

World Bank, (2006). Reengaging in agricultural water management: challenges and options. World Bank Publications, 2006. p58

World Bank, (2010). Report on the status of Disaster Risk Reductionin Sub-Saharan Africa. World Bank Press.

WRI, (2015). Climate Change in Nepal: Impacts and Adaptive Strategies. World Resources Institute. Retrieved 24 August 2015, from http://www.wri.org/our-work/project/world-resources-report/climate-change-nepal-impacts-and-adaptive-strategies

WRI. (2005). The Wealth of the Poor*: Managing Ecosystems to Fight Poverty*, World Resources Institute.

Wright, (1999)

WWF (1997). *Coastal Forest Conservation Unit Fact Sheet.* Nairobi, WWF - Eastern Africa Regional Programme Office.

Yemshaw Y, Amente G. (2003). Nature of confl ict and resolution strategies in Modjo Forestry project. Eastern and Central Africa Programme for Agricultural Policy Analysis (ECAPAPA) report.

APPENDICES

Appendix I: Letter of Introduction

Date ……/……../2015

TO WHOM IT MAY CONCERN

Dear Sir/Madam:

REQUEST FOR COLLECTION OF DATA

My name is **ADINOYI ADAVIZE JULIUS**, a post-graduate student at the Department of Sociology and Social Works, Faculty of Arts, College of Humanities and Social Sciences, University of Nairobi.

I am conducting a research study titled "Participatory Forest Management and Disaster Risk Reduction: The Case of Arabuko-Sakoke Forest Management in Coastal Region of Kenya*".*

You have been selected to form part of this study.

Kindly assist by filling in the attached questionnaire. The information given will be treated in strict confidence and will be purely used for academic purposes.

Your assistance and cooperation will be highly appreciated.

Yours Sincerely,

Adinoyi Adavize Julius
(Student)
C50/71729/2014

Appendix II – Consent Form

Title of the Study: "Participatory Forest Management and Disaster Risk Reduction: The Case of Arabuko-Sakoke Forest Management in Coastal Region of Kenya".

Institution: Department of Sociology and Social Works, Faculty of Arts, College of Humanities and Social Sciences, University of Nairobi, P.O.BOX 30197-00400, Nairobi.

Investigator: Master. Adinoyi A. Julius, P O Box PA 41275-00100, Nairobi

Supervisor: Dr. J. K. Kiemo, Department of Sociology and Social Works, Faculty of Arts, College of Humanities and Social Sciences, University of Nairobi, P.O.BOX 30197-00400, Nairobi.

Ethical Approval: National Council for Science and Technology / University of Nairobi Ethical and Research Committee.

Permission is requested from you to participate in this research study. With principles that You:

Voluntarily agreement to participate in this study is voluntary
May wish to withdraw from the study at any point you deem fit.
May seek clarity to understand the nature and importance of this study

Purpose of the study: To examine Disaster risk reduction (DRR) linkage with Participatory Forest Management (PFM) in Arabuko Sokoke Forest (ASF).

Procedures to be followed: With your cooperation, you will answer questions related to the objectives of this study. All information obtained will be handled with confidentiality.

Risks: There will be no risks involved in this study to you.

Benefits: There may be no direct benefits to you but the results of this study will be useful in understanding the disaster risk reduction mechanisms in ASF in order to further inform policies and practices that put DRR into consideration in Kenyan forest management.

Assurance on confidentiality: All information obtained from you will be kept confidential and used for the purpose of this study only.

Contacts: you may wish to contact me with regards to issues concerning this study through any of the various addresses provided above.

I now request you to sign the consent form attached

2

CONSENT FORM

"Participatory Forest Management and Disaster Risk Reduction: The Case of Arabuko-Sakoke Forest Management in Coastal Region of Kenya".

I _____ (respondent) give consent to the investigator to use the information that I will provide him as part of his study and that the nature of the study has been explained to me by the ……..

Signature_____ Date_____

I (field agent/researcher) confirm that I have explained the nature and effect of the study.

Signature_____ Date_____

Appendix III Questionnaire for ASF Community

Questionnaire Ref No. …… **Date ……./……../2015**

Part A: General Information

1. Name of Association? _____
2. Gender Male [ ] Female [ ]
3. What is your age? _____Years
4. What is your period of membership in the association? _____Years
5. Level of education? _____
6. What is your income monthly (30 days)? _____ Ksh
7. What is your occupation? _____
8. Household size? _____

Part B:

9. Tick all that applies as threat to the forest/people, and if there are awareness and sensitization campaign about them

Factors	Threat	Awareness and sensitization about Threats/and its implication
Logging (Legally)	[ ]	[ ]
Illegal logging	[ ]	[ ]
Poaching of animals	[ ]	[ ]
Forest encroachment	[ ]	[ ]
Harvest of non-timber forest products	[ ]	[ ]
Mining	[ ]	[ ]
Agricultural malpractices	[ ]	[ ]
Property/farm destruction by animal	[ ]	[ ]

10. **NOTE: The analysis of this question captures only the data from the association's heads or his executive representative as directed to answer this question.**

    What are the association's major guidelines regarding the management of threats you identified; and what measures do you take to reduce the threats identified?

Factors	Guidelines	Measures to reduce the threat
Logging (Legally)		
Illegal logging		
Poaching of animals		
Forest encroachment		
Harvest of non-timber forest products		
Mining		
Agricultural malpractices		
Property/farm destruction by animal		

11. Tick the following disaster you have experienced in the forest, their occurrences and specify the impact it had on you

Disaster Experienced		Last occurred	At least once in	Impact
Deforestation	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Forest fire	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	

Landslide	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Desertification	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Flooding	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Pollution	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Drought	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Famine	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Disease epidemic	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Fuel/Water crisis	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Resource based conflict	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	

12. In the event of the disaster you have experienced, tick (all that apply) if there were early warning system, personnel to respond and resources to respond; and specify who provided them?

Disaster Experienced						
Disaster	Early warning system/ provider		Personnel to respond/ Provider		Resources to respond/ Provider	
Deforestation	[ ]		[ ]		[ ]	
Forest fire	[ ]		[ ]		[ ]	
Landslide	[ ]		[ ]		[ ]	
Desertification	[ ]		[ ]		[ ]	
Flooding	[ ]		[ ]		[ ]	
Pollution	[ ]		[ ]		[ ]	
Drought	[ ]		[ ]		[ ]	

Famine	[ ]		[ ]		[ ]	
Disease epidemic	[ ]		[ ]		[ ]	
Fuel/Water crisis	[ ]		[ ]		[ ]	
Resource based conflict	[ ]		[ ]		[ ]	

13. **NOTE: The analysis of this question captures only the data from the association's heads or his executive representative as directed to answer this question.**
What are the association's policies regarding the following disasters?

Disaster	Policies
Deforestation	
Forest fire	
Landslide	
Desertification	
Flooding	
Pollution	
Drought	
Famine	
Disease epidemic	
Fuel/Water crisis	
Resource based conflict	

14. Tick your access to the followings in the forest:

Water	[ ]
Grazing	[ ]
Bee-farming/Honey Harvesting	[ ]
Gaming	[ ]
Firewood	[ ]
Medicinal Plants	[ ]
Nuts and Seeds	[ ]
Eco-tourism	[ ]
Others access (Specify): _____ _____ _____ _____	

15. Have you benefited from the government financial support 'in-form of loans or grants etc.' through your association? Yes [ ] No [ ]
16. Are you in any other social groups 'like friends, religious among others' that help in managing the forest? Yes [ ] No [ ]

    If yes, specify and in what ways those groups have helped

    _____
    _____
    _____
    _____
    _____

17. In what ways has the forest management agreements helped you?

    _____

_____

_____

_____

_____

_____

18. What rules should the government put in-place in order to reduce disaster risk?

i. _____

ii. _____

iii. _____

iv. _____

v. _____

19. What practices should be encouraged or stopped to ensure the forest sustainability and risk reduction?

_____

_____

_____

_____

_____

Appendix IV Interview Guide for Key Informants

Interview Guide One *Ref No.*…… Organization ……

Date ……./……../2015

Part A: General Information

1.What is your position in the Association? _____

2. Gender Male [ ] Female [ ]

3. Age _____Years

4. How long have you been in the organization? _____Years

Part B:

5. What are the common risks in the forested area of Arabuko Sokoke forest?

_____

_____

_____

_____

_____

_____

_____

_____

6.What are the disaster risks among the forest adjacent community of Arabuko Sokoke forest?

_____

_____

_____

_____

_____

_____

_____

7. How do those risks in the forest affect the community?

8. What increases the vulnerability of the forest adjacent community to disaster risks?

9. What are the policies and practices regarding those risks?

10. What are the measures instituted by the forest community to decrease disaster risks?

11. What measures have your organization put in-place to reduce those risks to the forest and the community?

12. What policy and practice needs to be recommended and enforced in the forest adjacent communities and forest management organs to ensure sustainable management that reduces risks?

Interview Guide Two for National Disaster Operation Centre (NDOC); and Kenya Forest Research Institute (KEFRI)

Interview Guide *Ref No.*…… Organization …… Date ……./……../2015

Part A: General Information

1. What is your position in the Organization? _____
2. Gender Male [ ] Female [ ]
3. Age _____Years
4. How long have you been in the organization? _____Years

Part B:

5. Tick all that applies as threat to the Arabuko Sokoke forest/people, and if there are awareness and sensitization campaign about them

Factors	Threat	Are there Awareness about those factors	The Implications of those factors
Logging (Legally)	[ ]	[ ]	
Illegal logging	[ ]	[ ]	
Poaching of animals	[ ]	[ ]	
Forest encroachment	[ ]	[ ]	
Harvest of non-timber forest products	[ ]	[ ]	
Mining	[ ]	[ ]	
Agricultural malpractices	[ ]	[ ]	
Property/farm destruction by animal	[ ]	[ ]	

6. What are your organization's major guidelines regarding the management of threats you identified; and what measures do you take to reduce the threats identified?

Factors	Guidelines	Measures to reduce the threat
Logging (Legally)		
Illegal logging		
Poaching of animals		
Forest encroachment		
Harvest of non-timber forest products		
Mining		
Agricultural malpractices		
Property/farm destruction by animal		

7. Tick the following disaster that have been experienced in the forest, their occurrences and specify the impact it had on the forest/ forest communities

Disaster Experienced		Last occurred	At least once in	Impact
Deforestation	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Forest fire	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	

Landslide	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Desertification	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Flooding	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Pollution	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Drought	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Famine	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Disease epidemic	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Fuel/Water crisis	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	
Resource based conflict	[ ]		1yr [ ]; 2-3yrs [ ]; 4-5yrs [ ]; Never [ ].	

8. In the event of the disasters you identified to have occurred in Arabuko Sokoke forest, tick (all that apply) if there were early warning system, personnel to respond and resources to respond; and specify who provided them?

Disaster Experienced						
Disaster	Early warning system/ provider		Personnel to respond/ Provider		Resources to respond/ Provider	
Deforestation	[ ]		[ ]		[ ]	
Forest fire	[ ]		[ ]		[ ]	
Landslide	[ ]		[ ]		[ ]	
Desertification	[ ]		[ ]		[ ]	
Flooding	[ ]		[ ]		[ ]	
Pollution	[ ]		[ ]		[ ]	
Drought	[ ]		[ ]		[ ]	

9.What are the policies regarding the disasters you identified in previous questions?

Disaster	Policies
Deforestation	
Forest fire	
Landslide	
Desertification	
Flooding	
Pollution	
Drought	
Famine	
Disease epidemic	
Fuel/Water crisis	
Resource based conflict	

10. What rules should the government put in-place in order to reduce forest related disaster risk?

i. _____

ii. _____

iii. _____

iv. _____

11. What practices should be encouraged or stopped to ensure the forest sustainability and risk reduction?

i. _____

ii. _____

iii. _____

iv. _____