Irrigate or migrate?

Local livelihood adaptation in Northern Ghana in response to ecological changes and economic challenges

Inaugural-Dissertation

zur Erlangung der Doktorwürde

der

Philosophischen Fakultät

der

Rheinischen Friedrich-Wilhelms-Universität

zu Bonn

vorgelegt von

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aus

Wissen

Bonn 2010

Gedruckt mit der Genehmigung der Philosophischen Fakultät
der Rheinischen Friedrich-Wilhelms-Universität Bonn

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Tag der mündlichen Prüfung: 29.09.2010

Acknowledgements

First of all, I have to thank Dr. Julia Schindler for providing me with her data and survey sample. Without her assistance, the conduction of this study would not have been possible in this form. To the same degree, I also have to thank Dr. Wofram Laube, who ever was a knowledgeable and amicable tutor. His advices were (in nearly all cases) very valuable for my work. A very big thank you also goes to Prof. Dr. Solvay Gerke for providing me with a very adequate field research time period and - last, but definitely not least - to Prof. Dr. Hans-Dieter Evers for his patient, excellent and inspiring supervision of this thesis. The underlying research of this thesis was mainly undertaken in the scope of the GLOWA Volta Project. This project is funded by the German Federal Ministry for Education and Research (BMBF). I am very grateful for the support of the ministry, which it has granted me on behalf of the German taxpayers. A special and very big thank you also goes to my (most beloved) wife Marijke Looman and Felizitas Scholten for doing the hard but very conscionable job of doing the proofreading of this thesis. I also thank the CGIAR Challenge Programme on Water and Food 'Contribution of informal shallow groundwater irrigation to livelihoods security and poverty reduction in the White Volta Basin: current extent and future sustainability' (CP 65) for its financial support of this thesis.

For their very trustful and enriching research cooperation with me, I have to cordially thank John Amegashitsi and Martha Awo. Without their hard research work and in particular without their important and interesting findings, this doctoral thesis would definitely be lacking very important information. I wish you both all the best for your academic and private future.

Furthermore, I am also very grateful to Jacob Afeliga for the great job he has done as a research assistant and in particular for sharing his huge knowledge with me. I really have enjoyed the field trips in North Ghana with him - even despite the terrible temperatures at the end of the dry season. For their really good work as interviewers, I also would like to thank Lambert Akanyapagra, James Atonga, Bennedict 'Big Ben' Baluah, Maxwell Abapoli, Isaac Apugi and Alice Atindema.

A special thanks for their assistance as well as for a nice company in Ghana and/ or at ZEF during my PhD phase also goes to the following persons: Jennifer Hauck, Salisu Adams, Mustapha Sachibu, Emmanuel Amoah, Elli Sokpoli, Abuyama Bennedicta Montrage - especially for providing me with cold drinks in the evening -, Ben Heywood, Daniel Ofori, Dr. Boubacar Barry, Prof. Dr. Eckart Ehlers, Prof. Dr. Jörg Blasius, Dr. Till Stellmacher, Dr. Irit Eguavoen, Cubura Laube-Adewuyi, Guido Lüchters, Dr. Jens Liebe, Dr. Saravanan V.S., Chian-Woei Shyu, Dr. Gabi Waibel, Dr. Günther Manske, Rosemarie Zabel, Dr. William Tsuma, Daniel Spalthoff, Prof. Dr. Steve Tonah, Dr. Bao Le Quang, Nana Ato Arthur, Dr. Anna-Katharina Hornidge, Dr. Fabian Scholtes, Kimberley Couvson, Emmanuel Derbile, Dr. Eva Youkhana and Dr. Charles Rodgers. Please note that the sequence of mentioning does not correlate with my personal degree of gratefulness towards the mentioned persons in any form.

Finally, I most notably have to thank my family. Particularly, I have to thank my mother and my grandparents as well as my wife Marijke Looman. Without their assistance, I even would not have been able to write this thesis at all.

Bonn, 19.10.2010 Benjamin Schraven

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Deutsche Kurzzusammenfassung

Der massive weltweite Zuwachs von Industrialisierung, Urbanisierung und Motorisierung hat in den letzten Jahrzehnten und Jahrhunderten zu einem globalen Prozess von klimatischem Wandel geführt bzw. zumindest zu diesem beigetragen. Dieser Prozess gilt mit seinen vorhergesagten Konsequenzen als eine der zentralen Herausforderungen der Menschheit im 21. Jahrhundert - wobei die wissenschaftlichen Prognosen bezüglich der Folgen des globalen Klimawandels aufgrund von einerseits methodologischen, andererseits politischen Bedenken durchaus umstritten sind. Gemein haben viele Klimamodelle und Zukunftsszenarien, dass vor allem die südlichen Erdregionen (Afrika, Lateinamerika, Süd- und Südostasien) als besonders von den Folgen des Klimawandels betroffen gelten. Die prognostizierten Konsequenzen in Form von zunehmender Armut und Ernährungsunsicherheit als Resultat von sich verändernden Regenzeiten oder Temperaturanstiegen sind für die arme, ländliche Bevölkerung, welche in Großteilen noch abhängig von Subsistenzlandwirtschaft ist, am verheerendsten. Die internationale politische und wissenschaftliche Debatte, wie mit den Folgen klimatischer Veränderung umzugehen ist, hat sich in den letzten zwei Jahrzehnten gewandelt: Während man sich in den Neunziger Jahren noch darauf fokussierte, wie der Prozess des globalen klimatischen Wandels aufzuhalten sei, so konzentriert sich die Diskussion in den letzten Jahren vielmehr auf den Begriff der Anpassung an den Klimawandel.

Weite Teile der Literatur betrachten Anpassung im Entwicklungsländerkontext vorwiegend als einen Prozess, welcher von Nichtregierungsorganisationen, Behörden oder Geberorganisationen initiiert bzw. vermittelt wird. Diese Betrachtungsweise lässt kaum Platz für Anpassungsprozesse, welche allein auf der Eigeninitiative etwa von lokalen Bauern beruhen. Weiterhin wird Anpassung in vielen Kontexten mehr oder weniger ausschließlich als Anpassung an den Klimawandel verstanden, was offenkundig bedingt ist durch die weltweite mediale und politische Präsenz des Themas klimatischer Wandel. Dabei haben sich beispielsweise Subsistenzbauern in Sub-Sahara-Afrika in ihrem Lebensunterhaltserwerb seit jeher an sich verändernde ökonomische (z.B. Strukturanpassungsprogramme in den 1980er Jahren), (nicht-klimatisch bedingte)

ökologische (z.B. Bodenerosionsprozesse) oder politische Rahmenbedingungen (z.B. Kriege) anpassen müssen. Die Vielzahl dieser Stressoren oder Verursacher von ‚Anpassungsdruck, machen Anpassung eher zu einem permanenten als zu einem Ad hoc - Prozess.

Diese Dissertation möchte einen lokalen, nur von Bauern initiierten Anpassungsprozess - flussnahe Kleinstbewässerungslandwirtschaft in Nord-Ghana während der Trockenzeit[1] - mithilfe eines *Livelihood*-Konzepts beschreiben, um einem (wie geschildert) multidimensionalen Anspruch des Anpassungskonzeptes gerecht zu werden. Dieser Analyserahmen versteht den Prozess des Lebensunterhaltserwerbs als kausal miteinander zusammenhängende Kombinationen der Elemente *Livelihood contexts* (beinhaltet z.B. Trends wie Bevölkerungswachstum oder makroökonomische Transformationsprozesse, die Anpassung erforderlich machen können oder neue Strategien ermöglichen), *Livelihood platform* (beinhaltet die notwendigen Ressourcen für den Anpassungsprozess) und *Access* (beinhaltet (soziale) Institutionen, Organisation und Beziehungen, welche Anpassungsressourcen vermitteln). Die Kombination dieser Elemente mündet in diesem Konzept zu einer *Livelihood strategy*, welche einen engen Nexus mit dem Begriff der Anpassung bildet, da Anpassung eine Diversifizierung, Optimierung oder Modifizierung der *Livelihood strategy/strategies* darstellen kann. Die Auswirkungen oder *Livelihood effects* sind dann ‚angepasst', wenn durch eine Anpassungsmaßnahme das bereits vorher vorhandene Maß an Sicherheit und Wohlstand erhöht bzw. die Verwundbarkeit des bisherigen *Livelihood portfolios* (Gesamtheit der *Livelihood strategies*) gegenüber den Stressoren verringert wurde. Zu den *Livelihood effects* gehört auch die Komponente der ökologischen Nachhaltigkeit.

Die konkrete Forschungsfrage, die diese Dissertation mithilfe des skizzierten analytischen Rahmens beantworten möchte, lautet: Warum ziehen Kleinbauern in den Einzugsgebieten zweier Nebenflüsse (Atankwidi und Anayare) des Weißen Voltas in der Upper East Region Nord-Ghanas mittlerweile in der Trockenzeit Kleinstbewässerungslandwirtschaft der traditionellen, sehr bedeutsamen saisonalen

[1] Diese Bewässerungsform basiert auf der Nutzung von oberflächennahem Grundwasser in und an Flussbetten, welche in der nordghanaischen Trockenzeit von etwa Oktober bis Mai völlig austrocknen. Mittels Pumpen in Wasserlöchern in den Flussbetten oder Eimern aus Brunnen an den Flussrändern wird das Wasser dann auf die flussnahe Felder transportiert um damit vorwiegend Tomaten zu kultivieren, die vor allem in Süd-Ghana verkauft werden.

Migration als Anpassungsstrategie vor bzw. welche zugrunde liegenden Prozesse und Dynamiken sind hier zu identifizieren?[2] Die dieser Dissertation zugrunde liegende Analyse stützt sich dabei vor allem auf Survey-Daten, die in den Jahren 2006, 2007 und 2008 in der Forschungsregion in kleinbäuerlichen Gemeinschaften erhoben wurden, sowie auf qualitative Interviews mit Bewässerungsbauern, saisonalen Migranten, usw.

Der Anpassungsdruck, dem sich die Bauern in der Forschungsregion ausgesetzt sehen, besteht vorwiegend aus sich verändernden Klimacharakteristika. Insbesondere eine stetig größer werdende Verschiebung und Variabilität der Niederschlagszeiten machen es vielen Subsistenzbauern schwer, den richtigen Zeitpunkt für die Aussaat des Regenzeitfeldbaus zu wählen. Dies führt zwangsläufig zu mehr Unsicherheiten und einer größeren Anfälligkeit für Ernteausfälle. Zwar gibt es durchaus auch andere ökologische Faktoren, die Anpassungsdruck erzeugen (wie etwa Bodenerosionsprozesse), doch wiegen diese sowohl in der Beurteilung der lokalen Bauern als auch in der wissenschaftlichen Analyse nicht so schwer wie die geschilderten klimatischen Veränderungen.

Traditionell stellt saisonale Arbeitsmigration von Nord- nach Südghana ein zentrales Anpassungsinstrument für viele nord-ghanaische Haushalte dar. Diese Migrationsform entwickelte sich schon im frühen 20. Jahrhundert, kurz nachdem die Briten das heutige Nord-Ghana (als *Northern Territories*) als Kolonie für sich deklarierten. Obwohl die britischen Kolonialherren anfangs noch mit Zwangsmaßnahmen und eher wenig Erfolg versuchten, Arbeiter für die von Arbeitskräftemangel geprägten Goldmienen in der Ashanti-Region und der ‚Goldküste' (also dem heutige Südghana) zu rekrutieren, so entdeckten viele Angehörige von kleinbäuerlichen Haushalten im Laufe der Jahre, dass temporäre Arbeitsaufenthalte im Süden durchaus vorteilhaft waren und gingen vermehrt auch auf freiwilliger Basis. Ihnen kam zugute, dass nach dem Ersten Weltkrieg im heutigen Süd-Ghana ein regelrechter Kakao-Boom einsetzte, der einen großen Arbeitskräftebedarf nach sich zog. Die Kakao-Kultivierungsphasen erlaubten es den

[2] Diese Arbeit wurde im Rahmen des Forschungsprojektes GLOWA Volta geschrieben, welches vom Bundesministerium für Forschung und Bildung (BMBF) finanziell gefördert wurde. Die Hauptaufgabe des Projektes ist die Analyse der sozioökonomischen und ökologischen Determinanten des Wasserkreislaufes des westafrikanischen Volta-Beckens in Zeiten globalen ökologischen und ökonomischen Wandels sowie die Schaffung eines entsprechenden Entscheidungsunterstützungssystems. Neben flussnaher Kleinstbewässerungslandwirtschaft wurden noch verschiedene Bewässerungsformen im Rahmen des GLOWA Volta Projektes analysiert.

Saisonarbeitern, während der Trockenzeit in den *Northern Territories* in den Kakaoplantagen des Südens zu arbeiten und rechtzeitig zu Beginn des Regenfeldbaus wieder im Norden zu sein. Die primäre ökonomische Wertschätzung, die von der Bevölkerung des Nordens dieser temporären Migrationsform entgegengebracht wurde, beruhte nicht so sehr darauf, dass die Migranten Geld oder Lebensmittel von ihren Aufenthalten im Süden mit zu ihren Familien brachten oder persönliche Wünsche (wie etwa das Errichten eines eigenen Gehöftes) der zumeist jungen, männlichen Migranten mit dem im Süden verdienten Geld erfüllt werden konnten. Wichtiger war für viele Subsistenz-Haushalte vielmehr, dass durch die Abwesenheit von einem oder mehreren ‚Essern' bzw. Nahrungsmittelkonsumenten die in der Regenzeit erwirtschafteten Nahrungsmittelvorräte viel länger für den Rest des Haushaltes reichten, was z.B. in Dürreperioden oder bei Epidemien von besonderer (Lebens-)Wichtigkeit war. Nach dem Zweiten Weltkrieg fanden saisonale Migranten im zunehmenden Maße auch Arbeit in anderen landwirtschaftlichen Sektoren neben dem Kakaoanbau und auch in städtischen Arbeitssektoren. Vor allem bedingt durch Verbesserung der Transportinfrastruktur von Nord nach Süd stieg die Zahl der Migranten vor und nach Ghanas Unabhängigkeit im Jahre 1957 stetig an. Der Strom von temporären Migranten, von denen sich immer mehr permanent in Süd- und Zentral-Ghana ansiedelten, riss nicht ab, was zu Jobengpässen für die Saisonarbeiter insbesondere in den Städten führte. Dies zog nach sich, dass sich die Vermittlung von bestimmten saisonalen Arbeitsplätzen - und in zunehmendem Maße auch Unterkünften - innerhalb ethnischer Gruppen aus Nord-Ghana manifestierte.

Insgesamt ging die Entwicklung der Nord-Süd-Arbeitsmigration in Ghana einher mit einer (bewussten oder unbewussten) Vernachlässigung der Entwicklungspotentiale Nord-Ghanas: Weder der britischen Kolonialverwaltung noch den ghanaischen Regierungen nach der Unabhängigkeit des Landes gelang es, bereits im späten 19. Jahrhundert formulierte Entwicklungsperspektiven für Nord-Ghana, die im Wesentlichen darauf zielten, den Norden zur Kornkammer Gesamt-Ghanas zu machen, effektiv in die Tat umzusetzen. Entsprechende Entwicklungsinitiativen wurden eher halbherzig umgesetzt, weshalb sich auch heute noch ein deutliches Nord-Süd-Gefälle bei verschiedensten Entwicklungsindikatoren wie Bildungs- oder Gesundheitswesen für Ghana ablesen lässt.

Aus Sicht der Bevölkerung des Nordens haben für die Ausbreitung des Phänomens Arbeitsmigration nicht nur ökonomische Erwägungen eine Rolle gespielt: Saisonale Migration hat in Ghana traditionell auch eine starke kulturelle Komponente - ein Faktor, der auch in der Migrationsforschung zunehmend an Bedeutung gewonnen hat. Diese kulturelle Wertschätzung ist eng damit verbunden, dass Migranten bestimmtes Wissen (etwa über neue landwirtschaftliche Kultivierungsmöglichkeiten) oder Gegenstände (wie etwa Fahrräder) mit nach Hause gebracht haben, die bis dahin in den Kommunen Nord-Ghanas unbekannt waren. Dabei wurden dieses Wissen oder diese Gegenstände nicht nur als an sich nützlich empfunden, sie galten vielmehr als eine Errungenschaft, die ‚Modernität' mit sich brachte. Dieser Aspekt war für viele ‚*Northerners*' von besonderer Wichtigkeit, denn ihre Eigenidentität wird bis in die Gegenwart hinein geprägt von einem Bild, das ebenso durch die Kolonialadministration als auch die Ethnien Süd-Ghanas gerne benutzt wurde und die Bewohner des Nordens als ‚wild', ‚unzivilisiert' oder ‚kriegslüstern' skizzierte. Auf der anderen Seite gab es ebenso bei politischen Verantwortungsträgern und auch der Bevölkerung stets Bedenken, dass die Migrationserfahrung vieler vorwiegend junger Nord-Ghanaer zu einem Prozess des kulturellen Wandels zwischen Jung und Alt beitragen könne, der schwerwiegende soziale Konflikte nach sich ziehen könnte. Das zeigt, dass die kulturelle Komponente im Bereich der Arbeitsmigration in Ghana seit jeher ambivalent ist.

Zwar hat das Erleben von ‚Modernität' bei vielen jungen Menschen zu Prozessen des Wertewandels im nördlichen Ghana beigetragen; nichtsdestotrotz hat die saisonale Migration in Nord-Ghana keine elementaren Veränderungen nach sich gezogen, im Hinblick auf die Grundfesten der sozialen Organisation sowie dem Festhalten an traditionellen Werten. Diese stellen (wie im Folgenden noch erläutert werden soll) eine wichtige Basis für das Ausbreiten von flussnaher Kleinstbewässerungslandwirtschaft dar. Die ersten Spuren der zahlreichen, heute in der Forschungsregion im Nordosten Ghanas lebenden ethnischen Gruppen wie etwa die Kassena oder die Nankana lassen sich vor etwa 300 Jahren finden, als sich die ersten Menschen dauerhaft auf dem Gebiet der heutigen Upper East Region niederließen. Vieles spricht dafür, dass die soziale Organisationsform der zu dieser Zeit noch sehr verstreut lebenden einzelnen Clans bzw. Sippenverbände eine vorwiegend hierachielose bzw. akephale war. Das Herrschaftskonzept der Häuptlingschaft blieb bis zum Beginn der kolonialen Herrschaft

in weiten Teilen Nordost-Ghanas unbekannt. Lediglich die Erdpriester (oder *tindaanas* in der lokalen Sprache Nankam), welche bis heute im spirituellen Sinne die Besitzer und Bewacher des Landes einer jeweils bestimmten Gegend sind, sowie einige ältere verdiente Krieger vermochten es, über politische Einflussnahme und - in bescheidenerem Maße - Macht zu verfügen. Die Lebensbedingungen zu jener Zeit waren ausgesprochen hart: die benachbarten Königreiche Gonja, Moshi und Dagomba stellten mit regelmäßigen und brutalen Raubzügen auf der Suche nach Sklaven oder materiellen Gütern für das Leben der lokalen Bevölkerung in den heutigen Upper East und Upper West Regionen eine große Gefahr dar. Es wurde im wahrsten Sinne des Wortes zu einer Lebensnotwendigkeit, dass einzelne Clans, so genannte *Sections* oder *Sub-sections*, welche sich bis heute durch patrilineare Verwandtschaftszugehörigkeit definieren und zugleich eine lokal begrenzte dörfliche Gemeinschaft ausmachen, mit anderen verbündeten, um der Verschleppung oder der Plünderung und Zerstörung der Heimatgehöfte durch feindliche Soldateska zu entgehen oder diesen kriegerisch entgegenzutreten. Lokale Solidarität innerhalb und unter den Clans entwickelte sich so zu einer wichtigen Norm, welche auch in nicht-kriegerischen Zeiten, etwa bei langanhaltenden Dürreperioden, eingefordert wurde und wird.

Die koloniale Epoche, die im heutigen Nord-Ghana erst im frühen 20. Jahrhundert mit der Eingliederung der *Northern Territories* in das britische Kolonialreich begann (siehe oben), sollte einige Änderungen für diese Solidaritätsmuster und sozialen Organisationsformen mit sich bringen. So begannen die Briten bereits kurz nach Erlangung ihrer Herrschaft über das heutige Nord-Ghana mit der Anwendung des berühmten Konzeptes der *indirect rule*; d.h. sie suchten nach vermeintlichen traditionellen Herrschern, die als Statthalter in den lokalen Clans und Gemeinschaften für das neu etablierte Kolonialregime agieren konnten. Da es, wie bereits erwähnt, in Nord-Ghana nur wenige Gemeinschaften mit dem ‚Amt' eines Häuptlings gab, ernannten die Briten kurzerhand jemanden zu einem solchen und statteten ihn mit dementsprechenden Machtbefugnissen aus. In anderen nördlichen Gebieten, wo dieses Herrschaftskonzept existierte, ersetzten sie den Häuptling mit einer andern Person, falls der bisherige Häuptling den Briten nicht wohl gesonnen war. Zumeist waren dies Personen, die bis dato nicht über nennenswerten Einfluss, geschweige denn Macht, verfügten. Dieser Eingriff in die lokalen Formen sozialer Organisation, neue

Landgesetze sowie die zwangsweise Einführung eines Machtbegriffes, der bis dahin in weiten Teilen der *Northern Territories* weitgehend unbekannt war, führten dazu, dass Häuptlinge bald als einflussreicher und machtvoller galten als Erdpriester. Auch die Versuche von Ghanas erstem Präsidenten nach der Unabhängigkeit, Kwame Nkrumah, die Macht der Häuptlinge zu beschneiden änderten daran nichts. Die Muster lokaler Kooperation und Solidarität veränderten sich insofern, als dass Solidarität auf Makroebenen, sprich: zwischen den Clans, so wie es einst lebensnotwendig war, in der Form nicht mehr existiert. Nichtsdestotrotz wird Solidarität z.B. in Form des Teilens von Lebensmitteln oder Geld mit Schwächeren oder weniger Begünstigten vor allem innerhalb der *Sections* und *Sub-Sections* und dort insbesondere innerhalb und zwischen benachbarten Haushalten nach wie vor praktiziert, da es noch immer eine wichtige soziale Norm darstellt - auch wenn solidarisches Handeln durchaus auch Neid, Eifersucht und Konflikte nach sich ziehen kann.

Lange galten kleinbäuerliche Werte und Normen in der internationalen wissenschaftlichen und politischen Entwicklungsdebatte als wesentliche Hemmnisse für Entwicklungsinitiativen. Wie aber schon angedeutet, spielen kleinbäuerliche Solidarität und die zugrunde liegenden Normen, welche einen wesentlichen Bestandteil der *Livelihood platform* ausmachen, eine ganz entscheidende Rolle bei der Ausbreitung von oberflächennaher Kleinstbewässerung im Forschungsgebiet. Die Bauern, die diese Bewässerungsform als erste anwandten, haben ihr relevantes Wissen aus verschiedenen Quellen erworben - teilweise haben sie vorher Farmen an den staatlichen Bewässerungsdämmen in der Region bewässert oder sie haben Bewässerungstechniken bei Arbeitsaufenthalten in Süd-Ghana erlernt oder ihr ‚Bewässerungswissen' beruht auf Bemühungen der britischen Kolonialverwaltung, Bewässerungslandwirtschaft in Nord-Ghana zu verbreiten.[3] Diese lokalen Innovatoren teilten ihr Wissen bereitwillig und unterwiesen andere Bauern darin, die ebenfalls Bewässerungskultivierung in der Trockenzeit praktizieren wollten. Im Bezug auf die anderen wesentlichen Produktionsfaktoren (oder *Access*-Faktoren) Land und Arbeit profitierten und profitieren Neu-Bewässerungsbauern von Landpachten, die vorwiegend aus

[3] In einem Dorf am Anayare-Fluss (Telania) unterwiesen britische Landwirtschaftexperten die lokalen Bauern schon in den 1930er oder 1940er Jahren in flussnaher Kleinstbewässerung. Bewässerungslandwirtschaft verbreitete sich fortan aber nur eher langsam in den benachbarten Dörfern bis zum Boom in den Neunziger Jahren.

symbolischen Preisen bestehen (falls sie kein geeignetes Landstück am Flussbett besitzen), und bei begrenzten Arbeitsressourcen kann zudem auf Arbeitsaustausch oder - ebenfalls für eher symbolische Bezahlung - angemietete Arbeit zurückgegriffen werden, wovon insbesondere Frauen und jüngere Männer profitieren.

Lediglich die Vermarktung der durch flussnahe Kleinstbewässerungslandwirtschaft kultivierten Tomaten, die vorwiegend für den süd-ghanaischen Markt produziert werden, kann nicht durch Solidaritätsbeziehungen innerhalb oder zwischen kleinbäuerlichen Gemeinschaften gewährleistet werden. Der Handel mit den frischen Tomaten wird gänzlich von süd-ghanaischen Handelsvereinigungen dominiert, die fast ausschließlich aus weiblichen Händlern bestehen. An den Spitzen dieser durch eine straffe Hierarchie gekennzeichneten Vereinigungen stehen traditionell so genannte ‚*Market queens*'. Verbesserungen der Straßen-Infrastruktur in den Neunziger Jahren erlaubten einen verstärkten Nord-Süd-Handel von Tomaten innerhalb Ghanas und verursachten somit maßgeblich den Boom von flussnaher Kleinstbewässerung. Durch die Bestimmungen der westafrikanischen Wirtschaftsgemeinschaft ECOWAS können ghanaische Tomatenhändler auch im benachbarten Ausland ihre Ware zollfrei einkaufen. Da die Tomatenproduzenten in Burkina Faso mittlerweile ihre Produktion auf die Bedürfnisse ghanaischer Konsumenten umgestellt haben, kauften mehr und mehr ghanaische Händler ihre Tomaten im nördlichen Nachbarland. Diese Entwicklung führte soweit, dass in der Trockenzeit 2006/2007 nur ein kleiner Teil der nord-ghanaischen Kleinbauern ihre Tomatenernte überhaupt verkaufen konnte. Die überwiegende Mehrheit der Bauern, die in der Forschungsregion flussnahe Kleinstbewässerungslandwirtschaft betrieben, machte folgerichtig große finanzielle Verluste. Versuche der ghanaischen Regierung - die die ganze Bewässerungsentwicklung ansonsten kaum zur Kenntnis nimmt -, eine eigene Tomatenverarbeitungsindustrie wiederzubeleben, um dieses Marktversagen in der Zukunft zu verhindern, bleiben bis dato weitestgehend wirkungslos. Die Konkurrenz auf diesem Markt ist vor allem durch hoch subventioniertes Tomatenmark aus Europa oder Amerika nahezu erdrückend hoch. Somit bleibt Marktversagen neben Wasserknappheit oder Pflanzenkrankheiten ein stetiges Produktionsrisiko für kleinbäuerliche Tomatenproduzenten Nord-Ghanas.

Dennoch hat flussnahe Kleinstbewässerungslandwirtschaft generell positive *Livelihood effects* für die betreffenden Kleinbauern und ihre Familien gebracht. Ihr Lebensstandard ist im Vergleich zu Haushalten, in denen niemand Bewässerungslandwirtschaft betreibt, eindeutig höher, und das obwohl die Mitglieder letztgenannter Haushalte stärker in nicht-landwirtschaftliche Erwerbstätigkeiten involviert sind als die Mitglieder von ‚Bewässerungshaushalten'. Neben einem erhöhten Lebensstandard ist es aber vor allem ein erhöhtes Maß an Ernährungssicherheit, welches Kleinstbewässerung durch das zusätzliche Geldeinkommen zu einer erfolgreichen Anpassungsstrategie macht. Strittig und letztendlich unbeantwortet bleibt die Frage bezüglich der ökologischen Nachhaltigkeit dieser Agrarbewirtschaftungsform - insbesondere im Hinblick auf die Folgen der Bodenfruchtbarkeit oder auch die hydrologischen Auswirkungen.

Es ist aber letztendlich nicht der Erfolg des Trockenzeitfeldbaus alleine, der saisonale Migration zu einer weniger beliebten Lebensunterhaltsstrategie macht. Die Lebens- und Arbeitssituation von Saisonarbeitskräften hat sich in den letzten Jahren bzw. Jahrzehnten deutlich verschlechtert: Nicht zuletzt bedingt durch eine stärker werdende Mechanisierung der kommerziellen Landwirtschaft Süd-Ghanas wird es schwieriger, Anstellungen und Unterkünfte zu finden. Infolgedessen verschulden sich immer mehr Arbeitsmigranten und auch Ausbeutungspraktiken auf Seiten der Arbeitgeber nehmen zu. Auch die Vermittlung von Unterkünften und Stellen innerhalb von ethnischen Netzwerken kann diese Entwicklungen nicht kompensieren. Andererseits lässt sich mit Hinblick auf die kulturellen Komponenten feststellen, dass Facetten von ‚Modernität', welche einstmals einen Reiz ausübten, zum Arbeiten in den Süden zu gehen und kulturelle Wertschätzung bedingten, nunmehr auch in Nord-Ghana vor Ort zu finden sind: Aktuelle Tageszeitungen, Fernsehgeräte, Radios, Tonträger, westliche Kleidungsgegenstände, usw. sind auf zahlreichen Märkten des Nordens erhältlich bzw. weit verbreitet. Es besteht also nicht mehr die Notwendigwendigkeit, diese Dinge oder neues Wissen im Süden zu erwerben, weshalb die kulturelle Wertschätzung bei weitem nicht mehr so präsent ist wie noch in früheren Jahrzehnten. Arbeitsmigration während der Trockenzeit wird fast ausschließlich aus ökonomischen Zwängen wie Ernährungssicherung heraus unternommen. Insbesondere für die Bewässerungsbauern bleibt saisonale Migration eine Notfalloption, falls es etwa (wieder) zu einem weitgehenden Marktversagen im Tomatensektor kommt. Dieses zeigte sich

insbesondere im Krisenjahr 2007, als die Anzahl der Bewässerungshaushalte mit Arbeitsmigranten doppelt so hoch war wie im Jahr zuvor und im Jahr danach.

Abschließend lässt sich gewissermaßen als eine Quintessenz dieser Dissertation feststellen, dass die Ausbreitung flussnaher Kleinstbewässerungslandwirtschaft im Forschungsgebiet Nord-Ghanas ein gutes und auch erfolgreiches Beispiel für einen lokalen Anpassungsprozess ist, der unterstreicht, dass kleinbäuerliche Werte- und Normensystem nicht entwicklungshemmend, sondern im Gegenteil sogar entwicklungsfördernd sein können. Das Prinzip, dass durch Solidarbeziehungen und die ihnen zugrundeliegenden Normen gewährleistete Vermittlung von Land, Arbeitskraft und Wissen, wichtige Ressourcen für flussnahe Kleinstbewässerungslandwirtschaft organsiert werden, funktionierte so ähnlich auch lange bei der Vermittlung von Arbeitsplätzen und Unterkünften für saisonale Migranten durch ethnische Netzwerke von Nord-Ghanaern in Süd-Ghana. Allerdings können diese Netzwerke die durch Mechanisierungsprozesse in der süd-ghanaischen kommerziellen Landwirtschaft eingeläuteten Bedeutungsverlust der körperlichen Arbeit von Saisonarbeitern und damit einhergehenden Begleitumstände (Jobknappheit, Arbeitsausbeutung, etc.) nicht kompensieren. Paradoxerweise stellt das, was flussnahe Kleinstbewässerungs-landwirtschaft in dieser Form erst möglich gemacht hat - die Öffnung bzw. Erweiterung von Märkten und Marktzugangsstrukturen - zugleich auch eine Bedrohung für diese Entwicklung in Form von Marktversagen dar.

'Much of the social history of the Western world over the past three decades has involved replacing what worked with what sounded good. In area after area […] the situation has gotten worse after the bright new theories were put into operation. The amazing thing is that this history of failure and disaster has neither discouraged the social engineers nor discredited them.' (Thomas Sowell)

'There is always something new out of Africa.' (Pliny the elder)

I Introduction

At all times, people had to adapt to processes of ecological change. But the strategies and mechanisms of the adapting of livelihoods to those processes have certainly gained more and more global attention since the effects of climate change are said to be one of the most crucial topics (not only) in the field of development studies and development practice in the 21st century; even though there always has been critique on the accuracy and the underlying methodological approaches of the estimated dramatic consequences of global warming and its alleged implications for adaptation measures (e.g. Dessai et al. 2009) or its interference with certain political agendas, respectively (e.g. Lomborg 2007).

However, the worldwide substantial growth rates of industrialization, motorization and urbanization within the last decades and centuries have (at least) contributed to a global process of climate change, which is expected to become a fundamental challenge of mankind in the 21st century. Its assumed short-term consequences in form of natural disasters, such as floods, droughts or cyclones, as well as its long-term consequences like dramatic shifts of rainfall patterns, rising temperatures, desertification or rising sea levels, have the potential to significantly affect agricultural production worldwide. In particular the livelihoods of millions of agricultural small-scale producers in the developing countries in the tropics and sub-tropics are considered to be endangered by environmental degradation and its effects, which are not necessarily and solely caused by results of climate change. Especially for the poor rural population in these countries, processes of ecological degradation are a predicted threat to their livelihoods, which manifests itself in the form of rising levels of poverty and food insecurity.

Within the last two decades, the international debate concerning the main challenge of the alleged consequences of global environmental change shifted from attempts of mitigation these changes to finding means and ways of adapting to them. Wide parts of the literature mainly perceive the adaptation of livelihoods in rural areas of the developing world as a procedure which is or has to be initiated by NGOs, governmental organizations or international donor agencies (e.g. Agrawal 2008; Reid and Vogel 2006). However, this 'mediating' perception on adaptation does not address processes which are solely based on the initiative of local people and pushed forward by them, respectively. In the following, these local developments will be understood as activities where individuals or communities on site generate adaptive measures that are spread without the mediation or interference of donors or agencies. This study will prove that local processes of livelihoods adaptation can be mainly based on existing local knowledge, local institutional settings and local patterns of social organisation. In contrast to that, the mediating perception on livelihood adaptation aims at establishing new regimes for adaptation related resources. Secondly, this thesis wants to deal with the adaptation of livelihoods in a holistic perspective. This means that it does not only cover climate or other ecological parameters since several studies on farmers in Sub-Saharan Africa (e.g. Ponte 2002; Bryceson 2002) underline that within the last decades, besides climate change, also many political, demographic or economic processes like the structural adjustment programmes in Sub-Sahara Africa during the 1980s have severely affected peasant livelihoods and have 'called into play a multitude of diverse and dynamic activities geared towards making a secured livelihood' (Yaro 2006: 126). Although many authors from the mid 1990s onwards have diagnosed a trend towards deagrarianisation in Sub-Saharan Africa[4], subsistence farming is still the central element of a large majority of African rural people's livelihood portfolios. At the same time, peasant or small-scale agriculture is increasingly being perceived as a future rather than a phase-out model for the agricultural development in Africa in times of severe ecological, political and economic changes and challenges - contrary to the traditional

[4] Kearney (1996:141) even suggested to use the term 'polybian' instead of the traditional term peasant due to the large number of economic activities besides subsistence farming members of a agricultural smallholder household maybe involved in (e.g. labour migration or off-farm work in the home community (see also Bryceson 1996).

modernization theory driven view on small-scale agriculture (Toulmin and Guèye 2005).

This thesis has been written in the framework of the GLOWA Volta Project (GVP). The German Federal Ministry for Education and Research (BMBF) has launched several research projects, whose foci are on global climate change and its interference with local hydrological and socio-economic conditions. The GLOWA Volta project was initiated as one of these projects. The overall objective of this project is the analysis of the socio-economic and physical determinants of the hydrological cycle in the West-African Volta Basin in the face of global environmental change. The project's main aim is the establishment of a scientifically sound Decision Support System (DSS) for all relevant stakeholders and actors in the area of water resource management. Particularly, the availability and the management of water under changing environmental conditions is one of the most important objectives of the GLOWA Volta Project.

Within the overall project, different types of irrigation and their livelihood-adaptive potential were studied from the beginning of the project onwards. The specific hydrological and socio-economic impacts of different irrigation systems represented an important element in the research agenda of the project. In order to understand the impacts and drivers of the expansion of irrigation farming, also the expansion of shallow groundwater irrigation (hereafter SGI) in Ghana's Upper East Region - a purely farmer driven expansion process - became one of the project's research focuses. SGI can be perceived as an income earning strategy to reduce vulnerability: besides other ecological changes, the Upper East Region, Ghana's second-poorest region, is expected to be affected by processes of climate change like enhanced rainfall variability leading to an increased vulnerability of the local peasant population towards harvest insecurity and thus also towards food insecurity. These predicted effects of ecological change are no longer 'still up in the air' but can be already felt at present by many small-scale farmers. SGI is an irrigation form that is based on the use of near-surface groundwater close to small riversides, which usually fall completely dry during dry seasons in Northern Ghana. The groundwater is either pulled up with buckets out of wells on riverside plots or it is pumped out of dugouts in the riverbeds via motor pumps. This small-scale irrigation kind is practiced during the dry season to an increasing degree in several places in North-Eastern Ghana. Where until the early 1990s this irrigation form

was practiced by only a few farmers, a heavy boom of dry season SGI farming could be observed in the last one-and-a-half decades. There are several driving forces for that: SGI is not hard to learn for the local farmers and this knowledge can be easily shared among the farmers. Furthermore, the initial investment costs - at least for the farmers who do not use an irrigation pump - are comparatively low. Usually, there is no problem in accessing the necessary farm land and additional labour due to a high degree of local solidarity. Finally, infrastructural improvements have contributed to more attractive market channels for SGI farmers in the study region, where many of them cultivate tomatoes during the dry season. It can therefore be assumed that currently several thousand farmers in Ghana's North have adopted this cultivation method.

On the other hand, labour migration, which - although highly interlinked with patterns of regional underdevelopment - traditionally has been the most important way for peasant households in Northern Ghana to cope with natural disasters like floods or droughts but also to mitigate the consequences of food shortages or epidemics, is on the decline. Initially forced by the British colonial administration and later on a voluntary basis, many young 'Northerners' left in the dry season, where in the North no rain-fed cultivation is possible, to the Southern part of (pre-independent) Ghana to work in the goldmines or on cocoa farms. The peasant communities in the North started to appreciate this form of migration to an increasing degree as it did not only reduce the pressure on the home households' food stocks when one or more of its members went to the South to work during the dry season. But also cultural implications play an important role. Travelling to the south rose in the Northern population's esteem because it introduced their young men to concepts of modernity. Furthermore, the experiences and knowledge migrants could gain during their labour migration stays were widely regarded as very valuable for the home communities. Migration, also in its more permanent forms, has thus become a daily routine for wide parts of the North-Ghanaian population. But especially in the areas where dry season farming has become more important within the last years, migration flows have decreased.

At this point, the question is: why has SGI developed into such an attractive livelihood (adaptation) strategy in Ghana's North within the last years whereas seasonal migration as a strategy to mitigate the consequences of events threatening small scale farmers' livelihoods dropped significantly despite its traditionally high economic and cultural

appreciation? Or to be more precisely: what are the underlying social, political, cultural or economic factors leading to an increase in SGI and to a decrease in seasonal migration? This question will be the central research question for this thesis whereas not the decision making process on both livelihood strategies - SGI and seasonal migration - will be in the focus of the analysis but rather the specific developments of both adaptive processes in their historical, political, cultural and economic contexts. The complexity of households and further social structures which form livelihoods and their specific compositions make the adapting or non-adapting of certain strategies to more than just a simple 'either-or' decision as the title of this thesis - irrigate or migrate - involuntarily might imply.

Seasonal migration and SGI can both be regarded as livelihood strategies as well as livelihood adaptations at the same time. Based on the findings and suggestions of the relevant recent literature, a livelihood strategy can be understood as a process in which people access necessary assets via a complex setting of institutions, social relations or organisations. Therefore, an adaptation of a livelihood strategy is an adjustment or modification of the whole process, which is usually caused by certain triggers in the context of the livelihood system, e.g. changing ecological patterns affecting farming outcomes or changes in the economic framework conditions. Livelihood adaptation and livelihood strategy thus constitute a close nexus. To operationalize the central research questions, the theoretical construct of livelihood strategy/ adaptation and its theoretical and causal implications are the base for the analysis framework. The developed framework is the starting point for the further analysis of this thesis. In a second step, the region the study is covering will be introduced. Particularly, the current processes of ecological change and the traditional adaptive economic and cultural meaning of migration patterns as well as the interference of labour migration with regional underdevelopment will be described. Furthermore, the description of the local patterns of social organisation will be an important part of this thesis due to their crucial importance in the adaptation context. Based on that, an empirical part analyzes the processes of irrigation farming and seasonal migration within the described framework. Based on that, the research questions will be answered in the conclusion part.

II Local livelihood adaptation: an analysis framework

Although several studies (e.g. Freeman 1975) already used a livelihood concept, the livelihood approach in the field of development practice and its perception in academia gained its importance in the late 1980s and early 1990s. Kaag et al. (2003) argue that the IMF and World Bank driven Structural Adjustment Programmes of the 1980s were the initial point for this development. These programmes, which strived for combating poverty with macroeconomic instruments, such as market liberalisations and privatisation measures (predominantly in the Least Developed Countries), were already criticized in the 1980s, especially for being too insensitive for the real needs of the poor. For instance, the famous Brundtland-Report (UNWCED 1987), known for being the first publication that contains a definition of sustainable development, appeals to give more priority to the problem of poverty and in particular the problem of livelihoods.

At the same time, a 'fruitful cross-fertilisation of science and policy' (Kaag et al. 2003: 3) began. Influenced by the Brundtland-Report and other publications - such as the first Human Development Report (UNDP 1990) - Chambers (1987) and Chambers and Conway (1992) developed an influential concept for the analysis of sustainable livelihoods, which was taken over by many development NGOs, such as Oxfam or CARE. To a large degree, it was based on the works of Sen (e.g. 1982, 1985) and his capability approach, which stresses the meaning of substantial or 'positive' freedoms like the capability of living a life of normal length or having access to medical services in contrast to 'negative' freedoms, which mainly refer to the freedom from authority. Chambers and Conway (1992) define livelihood as something that:

'comprises the capabilities, assets (including both material and social resources) and activities required for a means of living'; furthermore is a livelihood sustainable 'when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future while not undermining the natural resource base' (Chambers and Conway 1992: 6).

Therefore, a livelihood is more than just to make a living, and, as de Haan and Zoomers (2003:7) emphasize, it is also more than just a man-to-land relationship, which was a major focus in the older livelihood literature. It is rather a holistic, causally interlinked

and permanent process which is embedded in a larger social, economic and physical landscape and ends up with the aim of income earning or making a living. Bebbington (1999) for instance defined livelihood as a process that:

'…..encompasses income, both cash and in kind, as well as the social institutions, gender relations, and property rights required to support and to sustain a given standard of living. A livelihood also includes access to and the benefits derived from social and public services provided by the state, such as education, health services, roads, water supplies and so on.' (Bebbington 1999: 2022)

The aim of generating a basis for making a living is the central element for the livelihood concept if the analysis of livelihoods does not want to run the risk of livelihood becoming 'a container for everything that goes on in human life' (de Haan and Zoomers 2003: 353).

However, as it will be described further in the following chapters, this study deals with peasants, whose traditional livelihood strategies are threatened by processes of environmental degradation and severe economic challenges. These developments will require and have already required adaptation strategies in the peasants' livelihood portfolios.[5] This leads to the question: what exactly can be understood by livelihood adaptation?

In general, livelihood adaptation can be described as a process of 'changes of livelihoods, which either enhance existing security and wealth or try to reduce vulnerability or poverty' (Davies and Hossain 1997:5). Besides, the adaptive capacity of a household also has to comprise the important element of enhancing abilities in order to address future risks (Eakin 2005). For that reason, adaptation is a response to a rather long-term process in contrast to coping strategies, which refer to short-term livelihood reactions in the consequence of unplanned or unforeseen crises following events like droughts or floods. A typical sequence of response to such unforeseen events would be the rapid establishment and diversification of new income sources, the utilization of reciprocal social capital bonds, the reducing of the current household size (e.g. via temporary migration), the sale of movable assets like livestock and last the sale of fixed goods like farm land or other realties. This sequence implies that farm households

[5] According to Ellis (2000), a livelihood portfolio can be understood as the number of activities that actually contribute to a peasant household's total income.

naturally first of all struggle for maintaining their future income by generating assets before selling assets which are essential for their future survival (Ellis 2000:44).

Livelihood adaptation processes have to rely on different mechanisms than coping processes since the former refers to reactions towards long-term changes affecting livelihoods. These long-term processes might be environmentally induced. Especially the global climate change is - and will be to a rising extent - a factor that will require the adaptation of millions of people's livelihoods to a large degree. Many climate models are predicting that agriculture in the Northern hemisphere (specifically in Northern America, northern Europe and in wide parts of Northern Asia) could largely benefit from the forecasted consequences of climate change (longer growing seasons, higher average temperatures, higher degrees of carbon dioxide in the soils, etc.). On the contrary, the predictions of several models for Africa, South-East Asia and Latin America bear analogies to a horror scenario, in particular in terms of their consequences for agriculture. According to these predictions, climate change-related changes of rain-fall patterns, increasing soil degradation or severe changes of vegetation covers will be leading to massive crop failures and consequently to a severe destruction of livelihood infrastructures in these regions of the world mentioned. These climate models assume that an accordant massive increase of cereal prices by the year 2060 cause hunger and starvation of between 60 and 350 million people in many of the tropical areas (Schaeffer 2005:294). But not only the food security situation - especially in Sub-Saharan Africa - is allegedly affected, also the availability of drinking and agricultural process water in many arid and semi-arid regions could be influenced by changing environmental patters. Furthermore, climate change could induce a further spread of severe diseases, such as malaria or meningitis (Boko et al. 2007:327-439).

These statements about climate change and its predicted partly very disturbing impacts - especially for Africa - have ever aroused massive criticism coming from very different societal and scientific areas. On the one hand, it is based on climatological methodology concerns, which are pointing out that knowledge on climate change is too inadequate to make such predictions or that local or regional climate data is taken for macro or global climate models (Pielke 2007; Dessai et al. 2009). Moreover, a lot of criticism is also focusing on the uptake of climate change alarmism by policy makers, mass media or

civil society groups and its underlying mechanisms for a certain policy oriented instrumentalization (e.g. Lomborg 2007).

Nevertheless, it is certain that besides local factors, patterns of climate change - as it will be described in the later chapters - can at least contribute to processes of environmental degradation or change that are severely affecting the livelihoods of rural poor households in those countries already belonging to the poorest ones in the world. In addition, it can significantly increase the potential for their further impoverishment. Since climate change is not only affecting long-term patterns, such as decreasing rainfall amounts, but also comes along with erratically appearing catastrophic events like droughts or floods, coping strategies and adaptation strategies evidently have to go hand in hand and furthermore cannot easily be distinguished from each other.

Long-term processes that require the adaptation of livelihoods may not only be of an ecological but also of an economic character. Similarly to the effects of global environmental change, economic changes have (had) severe affects on the livelihoods of many African agricultural smallholders in ambivalent ways. Traditional patterns of peasant agriculture in Sub-Saharan Africa to a great extent changed with the expansion of colonialism and the related forceful integration of African agricultural smallholder production into the world market. In the last two to three decades, economic globalization brought further considerable changes to peasant agriculture, such as the establishment of regional economic agreement, World Bank- and IMF-driven implementation of structural adjustment programmes as well as overall trade liberalizations. Until the beginning of the world food crisis in late 2007, the food crop sector - especially in Sub-Saharan Africa - has experienced a positive development starting with the introduction of the structural adjustment programmes. The private sector largely took over the marketing in the agricultural sector from the previously dominant public agencies. However, the increased degree of competition between buyers led to improvements concerning the payments for (mainly) commercial farmers - at least in terms of time. Also the local food crop consumers could at least partly benefit from liberalization measures since competition and a related higher efficiency of processing and marketing resulted in lower real prices for many food crops. But in many remote and infrastructurally weak areas, the abolition of general prices for agricultural inputs as well as the shortfall of input subsidies had very negative impacts

for many agricultural smallholders in those regions. The same miscellaneous effects could be observed in the field of export-oriented, commercial agriculture; some small-scale farmers could definitely benefit from globalisation by shifting their production patterns towards export-oriented cash crops as this sector also profited from increased competition that similarly has induced better payment conditions for the producers (Ponte 2002). But economic globalisation is also threatening livelihoods being dependent on commercially and export-oriented cultivation opportunities in the developing world due to an oftentimes wide lack of competitiveness with the agro-industry of industrialized countries, predominantly in terms of quality (Diao et al. 2007:21-22). According to Ponte (2002), the quality disadvantage is caused by high competition pressure between the buyers, which has amongst others led to widely disregarded quality controls. In addition, the weak competitiveness of commercially oriented farmers in developing countries is distorted by the subsidization of agricultural production in Europe and Northern America, which severely undermines the domestic production in many developing countries. The abolition of input subsidies thus certainly brought about additional negative effects for agricultural smallholders being engaged in commercial agriculture. Riddell (1992) comes to the conclusion that Sub-Saharan African peasants have therefore widely withdrawn from market opportunities and

> '… moved back into the so- called 'economy of affection'. Here, conditions may not be ideal, but at least there is some food to eat, and security can be found while meaningful kinship, locality, and ethnicity relationships are being fulfilled. Elsewhere this has been termed the 'exit option' whereby peasants distance themselves from an impersonal market that appears to have acted against them like a 'robber'. This is a simple act of avoiding exploitation' (Riddell 1992: 60-61; see also chapter V.1).

O'Brien and Leichenko (2000) have shown that both the process of global economic change as well as processes of global ecological changes cannot be seen as isolated phenomena. The analyst's task rather is to look at their combined and synergetic impact. But they are not the only economic and ecological change processes that cause threads to livelihoods. Also policy measures can induce adaptation; the example of structural adjustment programmes in Africa mentioned above has shown that agricultural policies (e.g. the withdrawal of many states from agricultural in- and output markets that led to massive changes in prices) have severely challenged many peasants' production and marketing modes; possibly to the same degree or more than globalization and changing

world market prices have done so far. Furthermore, there may be many other trends ranging from technological changes (which for instance may revolutionise cultivation forms) to certain demographic changes. Besides these ecological, political, demographic or economic trends, there are also shock events ranging from severe droughts to civil wars that may have a mid or long-term effect on old-established livelihood strategies and thus bring about the need for adaptation. Looking on the one hand at the complex melange of trends and shocks, which can be subsumed with the term 'livelihood contexts', and taking into consideration that many of these trends (e.g. world market prices) are of a very fluctuating nature, one can conclude that livelihood adaptation is often more a constant than a static process.

As already mentioned, these trends and shocks (livelihood contexts) create the need for adaptation - i.e. the reducing of households' vulnerability to these threats in order to increase or at least to maintain their standard of living, respectively. But what exactly is vulnerability? According to Benson and Clay (2005:1), the term vulnerability can be defined as the general potential to suffer harm or loss whereas this potential is made up by the degree of exposure to risk, shocks and stress. Kelly und Adger (2000) define vulnerability as:

'..the ability or inability of individuals or social groupings to respond to, in the sense of cope with, recover from or adapt to, any external stress placed on their livelihoods and wellbeing' (Kelly and Adger 2000: 328).

Vulnerability in the livelihood context has an internal aspect regarding all threats to a household's livelihood containing external risks as for instance the mentioned climate change induced effects or globalization-related local market failures as well as an internal aspect regarding a household's capabilities to deal with such threats what includes material assets, social capital, etc. (Ellis 2000:61-66). In other words, vulnerability or the extent to which households suffer from disasters is determined by the likelihood of being exposed to hazards and the capacity to withstand them, which again relates to the socio-economic environment of the household (Schneiderbauer and Ehrlich 2004:12-15). Important concepts in the context of vulnerability are also resilience and sensitivity. Originally coming from the field of ecology, the term resilience refers in the livelihood context to the ability of a social group or a community

to cope with external stresses or hazards deriving from ecological but also from social, economic or political change processes (Adger 1999:254-255). For instance, a household can be highly resilient when its members can easily rely on other food supply sources in case of a substantial crop failure. Sensitivity is the degree to which a natural or a social system can handle events from the outside without being severely effected in the long run (Adger 2006:270). Concluding, one can say that a highly vulnerable household is disposing of a very high sensitivity but a low resilience. Contrary, a less vulnerable household will have a high degree of resilience but a low degree of sensitivity.

Vulnerability is not one-dimensional. According to Mechler (2003:14), it - at least - contains the following dimensions, which are not only affecting the individual or household level:

- Physical vulnerability: this relates to the susceptibility to damage of engineering structure and infrastructure by a hazard
- Social vulnerability[6]: the ability to cope with impacts of a threat by the means of social capital (social networks, kinship groups, affiliations, formal or informal associations, etc.). This dimension is manifold; Chambers (1983) indicates that certain social obligations that are still of a very essential meaning in a rural society (such as bride price or the performance of funerals) can indeed enlarge the vulnerability and the ability to cope with hazards that are threatening livelihoods. So, the role of these social obligations might be ambiguous since they can also be seen as a security investment to enhance their existing social capital (see also chapters IV.4 and V.1).
- Institutional vulnerability: this dimension refers to the existence, robustness and the capacities of institutions to deal with and respond to hazards.

[6] The term 'social vulnerability' is oftentimes used in different ways throughout the literature; Kelly and Adger (2000) for instance define social vulnerability 'in terms of the ability or inability of individuals and social groupings to respond to, in the sense of cope with, recover from or adapt to, any external stress' (Kelly and Adger 2000: 328) to emphasize the human dimension in this context.

- Economic vulnerability: the last dimension of vulnerability is related to the economic or financial capacity to compensate losses and to return to a previously planned activity path. This may refer to private individuals, households, companies as well as governments that often bear a large share of a country's risks and losses.

One key role for adaptation and the reduction of such vulnerabilities holds according to Ellis (2000:14-15) the diversification of livelihoods. The diversification of rural livelihoods is defined as 'the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and to improve their standard of living' (Ellis 2000:15). The increase of a livelihood portfolio, in other words: the attempt to multiply the sources of income like off-farm labour, remittances from migration stays, etc., might be an outcome of a livelihood adaptation process, but diversification is not necessarily the only way of adaptation. Intensification, which is referring to existing income sources that are used more intensively to guarantee a higher income, is another option. According to Agrawal (2008:19), besides diversification and intensification, other instruments for livelihood adaptation - especially under the conditions of climate change and increasing climate variability - can be the storage of perishable food stocks and water. Furthermore, adaptive capacities can be strengthened with instruments clearly exceeding the borders of a sole rural household. Such measures would be the pooling of joint communal resources and activities, such as the sharing of labour, income from different sources or wealth among different households. But also (an increased) market exchange or a higher market orientation can be seen as a crucial instrument for adaptation in rural poor households. Additionally, an increased reliance on the factor mobility - from a dislocation of livestock and the seasonal migration of one or more household members to the point of a complete and enduring dislocation of a whole household - is an option in this context. All adaptive measures mentioned are of course not pure ideal types. Taken from real life experiences, livelihood adaptation instruments are nearly always a mixture of the different types named above. All these measures maintain, optimize, modify, rearrange the composition of livelihood strategies or change the geographical setting of the livelihood strategies a household relies on. Even the adaptation instruments themselves can to a large degree be a livelihood

strategy; thus, livelihood adaptation and livelihood strategies are generating a close nexus.

Generally, livelihood strategies are one of the main pillars of the sustainable rural livelihoods framework, which has been established and further advanced throughout the 1990s by several authors (Chambers and Conway 1992; Scoones 1998; Ellis 2000) as an analytic tool for the evaluation and understanding of the livelihoods of (rural) poor. Due to that, the analysis framework of this thesis, which will be described in the following, is based on the sustainable livelihoods framework. The activities subsumed under the category livelihood strategies, which in the following will be regarded as part of a close continuum with livelihood adaptation, may be natural resource-based and include the gathering or collection of tree/ forest products (such as firewood), the cultivation of food and non-food crops, livestock keeping or certain other non-farm activities. On the other hand, the strategy-related activities can also be non-natural resource based, which includes trade activities, certain services like repairs, rural manufacture, remittances from migration and other transfers like pensions from former formal employments (Ellis 2000:41). The classification of strategies is heterogeneous in the literature; Scoones (1998:3) for instance distinguishes between the livelihood strategies of agricultural intensification or expansion - which are both purely drawing on agricultural resources - livelihood diversification[7] (additional income generation via rural non-farm employment) and migration. Ellis (2000:14-15) criticises that this notion of diversification is too one-dimensional and cuts across livelihood typologies, meaning that households may diversify their livelihood portfolio via off-farm labour, migration remittances and agricultural intensification.

However, the outcome of an adaptation process (or the 'livelihood effects') might be positive and sustainable in the case of increased security and an adaptation by choice. In turn, the adaptation outcome might also be negative and accordingly unsustainable if the adaptation was initiated out of necessity without being able to increase the livelihood security level, which is leading to a more vulnerable livelihood system. With regard to what has been said about vulnerability and its reduction, a successful adaptation strategy

[7] The term livelihood diversification is restricted solely to non-farm activities in Scoones' (1998) interpretation.

has to spread the risks and uncertainties[8], which are necessarily attached to an accordant livelihood strategy chosen. In the case of livelihood diversification, Ellis (2000) has referred to 'families … in their means of survival do not pull all their eggs into one basket' (Ellis 2000:60); meaning that risk is managed and mitigated in this case by spreading income to several sources. In case one source of income fails, it can be absorbed by the rest. The theoretical debate on peasants and their attitude towards risk taking, which was an intense and crucial discussion in the field of development sociology and economics throughout the 1970s and 1980s, will be further commented on in chapter V.1.

Besides the elements 'livelihood strategies' and 'sustainable livelihood outcomes', Scoones' (1998:4) framework includes the elements 'contexts, conditions and trends'; 'livelihood resources/ assets' and 'institutional processes and organisational structures' (see figure II.1 for a schematic overview of the whole framework). This indicates that the chosen strategies and the chosen adaptation process are necessarily embedded in a certain institutional, ecological, economic and socio-political environment. Livelihood resources or assets and the chosen livelihood strategy are interconnected by mediating processes. The classification of those instances is manifold. For instance, whereas Scoones (1998:4) makes no distinction between institutions and social relations, Ellis (2000:37-39) underlines that social relations and institutions are not necessarily the same. Social relations are referring to the positioning and interactions of households and individuals with the outside world. This includes certain determining factors, such as age, gender, social stratification, religion or ethnicity, which all may - but not necessarily must - determine the access to livelihood assets.

[8] According to Ellis (1993:84-85), risk is restricted to situations where certain probabilities can *ex ante* be calculated concerning the occurrence of an event which will determine the decision making process concerning a livelihood strategy; whereas the term uncertainty refers to situations where an *ex ante* calculation of the probability that such an event occurs is virtually impossible. Ellis admits that in real life situations the differentiation between risks and uncertainties is complicated (if not impossible in some cases).

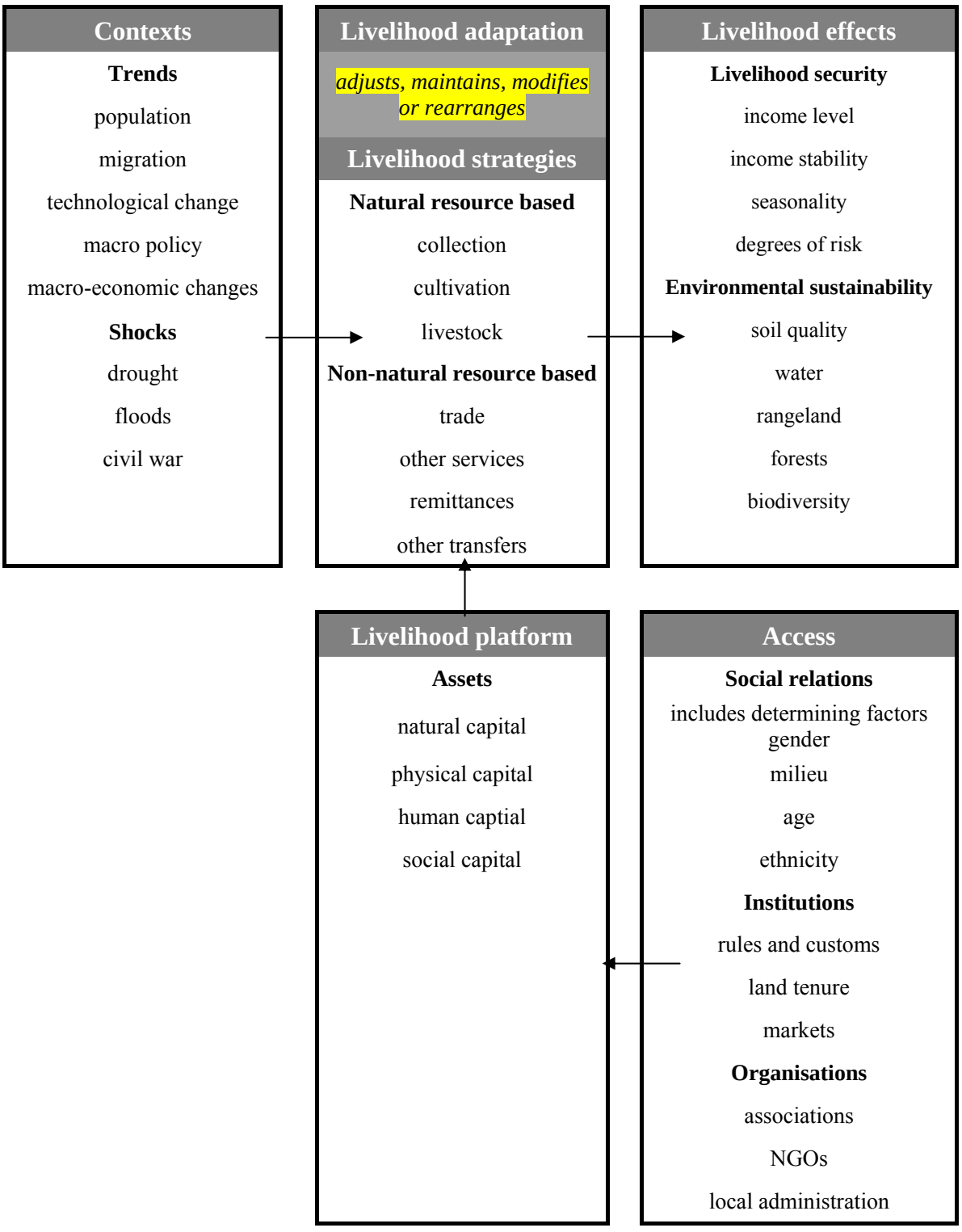
In contrast to social relations,

'…institutions are the social cement which link stakeholders to access to capital of different kinds to the means of exercising power and so define the gateways through which they pass on the route to positive or negative [livelihood] adaptation' (Davies 1997: 24).

Institutions comprise formal conventions and regulations, such as laws and property rights as well as informal behaviour codes (taboos, traditions, etc.). These 'rules of the game' (North 1991: 98) structure all kinds of economic, political and social interactions in order to reduce uncertainty. On the contrary, organisations, which are the third element of the 'access pillar', are groups of individuals, who are bound to this organisation to achieve a common purpose or objective.

In the context of livelihood adaptation as well as in other contexts, the perception of what institutions, organisations and social relations are is not unique and shuffled throughout literature. Agrawal (2008) for instance underlines that institutions have a very important function for livelihood adaptation whereas he rather refers to organisations than to institutions - at least according to the definition mentioned above. However, the general tenor of the adaptation literature is that it is of an essential meaning to gain a good understanding of the local organizational, institutional and social setting due to their key role in adaptation processes (Reid and Vogel 2006). In wide parts of this literature, however, this key role is limited mainly to the function to be meditative between locals and governmental actors, NGOs or donor agencies to take measures.

Figure II.1: A livelihood adaptation analysis framework



Source: own presentation, based on Ellis (2000:30), Scoones (1998:4) and Carney (1998:5)

Parsons (1961) - just to focus on sociological institutionalism[9] -describes institutions (namely norms and values) as both major criteria for the selection of goals of social action as well as crucial determinants for the selection of the respective means. But how and to what extent institutions play a role for a social interaction process - in this case an adaptation process - also depends on the collective group context in which this social interaction is taking place. A classic example is given by Tönnies (1991), who distinguishes between *Gemeinschaf*t (community) and *Gesellschaft* (society) as major arenas for social interaction processes. Social action in a community context, meaning social interaction within closer groups like kinship groups (e.g. nuclear family or kinship systems), local communities (e.g. neighbourhood, village communities) or 'spiritual' groups like circles of friends or colleagues, is based on a reciprocally intimate relationships. It is furthermore grounded on common group volitions and a strong sense of unity. On the other hand, societal interaction is more anonymous; actors are in a way reduced to those social roles which are specific for a certain situation. Whereas *Gemeinschaft* implies privacy, *Gesellschaft* is strongly associated with the public social sphere. Consequently, interaction within a community context - according to Weber's (1984) ideal types of social action - is at no time only a purposive-rational action, which means that an actor can never exclusively orient his action to an aspired purpose, the accordant means or expected side-effects. In the sphere of *Gemeinschaft*, traditional action, which is action based on 'settled' customs but contingent on particular situations, and value/belief-oriented social action depending on a strict belief in the intrinsic value of a certain aesthetic, ethical or religious issue play a more dominant role. Tönnies was ever criticised for giving a too 'romantic' and superelevated picture of *Gemeinschaft* and the consequences of a superiority of *Gesellschaft* for modern societies (e.g. Durkheim 2004, Mitzman 1971). Nevertheless, the basic social considerations of Tönnies' concept remain crucial: since local, farmer-driven adaptation processes are usually initiated within communal group contexts (village communities, neighbourhoods, etc.), it can be assumed that individual adaptation goals and actions are strongly embedded in the local systems of norms and values (see below and chapter V.1).

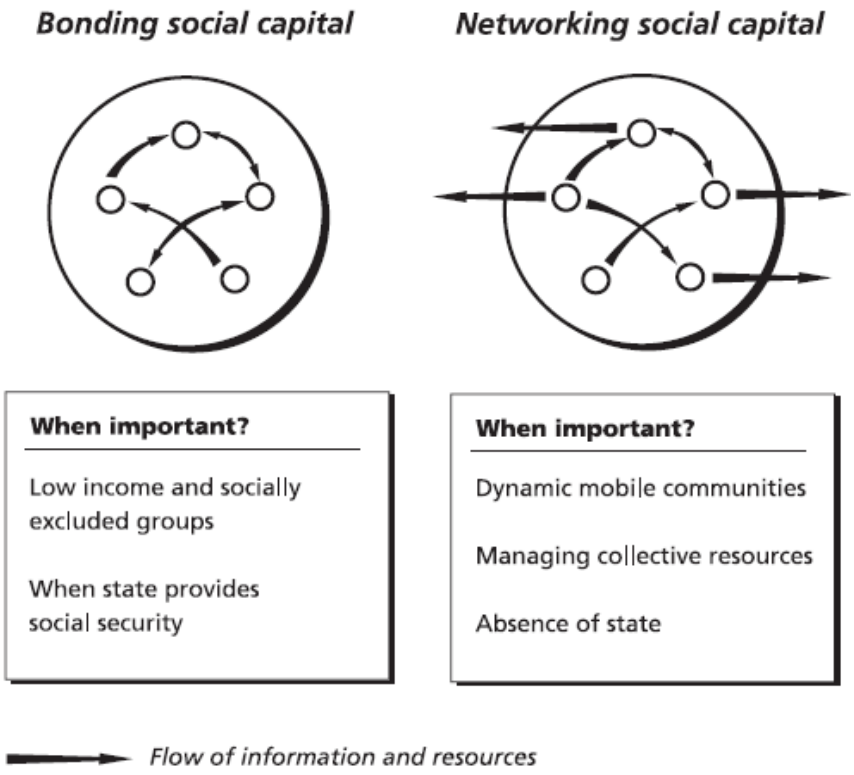
[9] Other kinds of 'new' institutionalism are historical, rational choice and ecological institutionalism, which shall remain excluded at this point.

However, all three elements of social relation, institution and organization are crucial factors in facilitating the access to the relevant livelihood assets or resources, which necessarily are the essential base of every livelihood strategy. Usually, livelihood resources are divided into natural capital (water, land, etc.), human capital (labour, knowledge, skills, etc.), physical capital (buildings, roads, machines, etc.), financial capital (savings, loans) and social capital. According to Bordieu's (1986) definition, social capital is 'the aggregate of the actual or potential resources, which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition' (Bourdieu 1986:248). Ellis (2000:39) underlines that the last mentioned kind of capital is closely related to the mediating processes: according to him, a community with a low social capital is most-likely manifested in poor network ties, malfunctioning organizations, weak associations and a low degree of reciprocity between households.

Despite different definitions and perceptions, social capital in the field of social science has been detected as a 'concept en vogue' (Bhuiyan and Evers 2005:12) within the last years, also in terms of sustainable development. Adger (2003) therefore sees social capital also as an integral element for livelihood adaptation ('Social capital is a necessary 'glue' for adaptive capacity' (Adger 2003:392)). In his argumentation, it is a major element of economic transaction and collective action, especially under the conditions of scarce and threatened natural resources. Social capital in this perception has two dimensions: a public and a private one, which are in a majority of analyses regarded as a whole and as one, respectively. Private social capital is associated with individuals and thus only reflects benefits for this individual. The public, communal or collective dimension of social capital is related to networks being perceived as public goods, which are enhancing the overall 'performance' rather than that of individual actors. Important is that those networks may be directly linked to local institutions. The last mentioned aspect is also underlined in the definition of social capital by Woolcock and Nayaran (2000), who define social capital as being made up of 'norms and networks that enable people to act collectively' (Woolcock and Nayaran 2000:226). Adger (2003:391-392) emphasizes that social capital is not existing in a political vacuum but alters the relations and in particular the power relations between the civil sector and the state. Vice versa, the state and especially its degree of activity in

providing (social) security also influences the specific form of social capital, which is important for adaptation capacities and implies the sharing of livelihood access related information and resources (market information, labour, land, etc.). Under the circumstances of the state providing security, Adger (2003) argues that bonding social capital is a favourable form of social capital, especially for low income groups and socially excluded groups. Bonding social ties are described as being predominantly based on family or wider kinship networks and locality. Under the circumstances of an absent state, networking social capital is becoming more important. This form of social capital exceeds the bonding ties as it is also based on linkages outsides the family-, kinship- or locality-based group. These external linkages are based on weaker bonds of reciprocity and solidarity (see figure II.2), which in a way picks up Granovetter's (1973) groundbreaking work on the importance of weak ties.

Figure II.2: Circumstances in which bonding and networking social capital are important for adaptation



Source: Adger (2003: 392)

An important issue in the context of livelihood adaptation is the aspect of decision making on livelihood strategies and accordingly livelihood adaptation. De Haan and Zoomers (2005) emphasize that the current research on livelihoods has to deal especially with this important challenge in order to achieve a deeper understanding of poor peoples' lives. Actually, this is an adequate analysis of the links between livelihood options and the decision making that is leading to an access to the relevant resources. Particularly, it is pointed out that households can no longer be seen as unitary decision-making units or as groups of persons, who share a majority of consumption aspects and production resources. The unitary or homogenous household model, which was principally dominant in the economic research until quite recently, implies that all individual household members' choices are determined by the strategic goals of the household as a whole (Goldstein and Udry 1999). Resulting from the upcoming gender studies, this household model got more and more questionable. For instance, Hill (1975) already showed that in the case of West-African farm households the assumption of a homogenous household strategy is at least disputable since:

> [In West-African farm households husbands and wives] 'seldom form a unified production unit ...[but] wives ... enjoy a large measure of economic autonomy ... [although] it is not to deny that there is much mutual dependence and complementarity … within the household' (Hill 1975: 123).

This means that the household is not only divided concerning different, gender-specific labour-tasks, but it is also divided in certain economic spheres with accordant implications for decision making processes. However, it took some time and some publications (such as Udry (1996)) before the unitary household model was finally rejected (also in the field of economics) and the consequences of this rejection were adequately recognised. The increasing neglecting of this model has automatically led to a greater attention to the several 'actors' of a household, such as men, women and children, and to the assumption that they all are following their very own interests and motives. Thus, the different actors are also driven to diversify their assets, activities or incomes. This diversity of different actors, who exploit different opportunities within closer or wider communities in order to achieve their different objectives, leads to the consequence that there might be open contradictions between individual and household

goals. Nevertheless, the household remains - at least partly - a common board of consumption; that is why it remains expedient (Guyer 1986).

Furthermore, the consequence for the household may be that its behaviour - if seen as a common one - is unconscious, undeliberate or unintentional and the concept of a household strategy is correspondingly doubtful (de Haan and Zoomers 2005:38-39). According to Guyer (1986), due to the largely interwoven consumption patterns, it still makes sense to use the household as a platform of analysis, especially in the case of long-term processes, what also includes adaptive strategies. The consideration of gender and intra-household relations in the research agenda therefore remains crucial. Concretely, the initial task of the analysis is to identify the relevant decision-making unit and to analyse the underlying structural determinants for a certain decision and their specific degree of interference with other parts of the household.

Besides, the decision making on livelihood opportunities is highly affected by diverse structural conditions the household and its members are exposed to. Those may be of a temporal, geographical, demographic or - as already mentioned - social capital related character. The temporal aspect includes the factor seasonality; the time of the year clearly determines the opportunities of which crops can be grown or which other economic strategies can be chosen. As it is the case for many regions in arid and semi-arid Africa (as for instance also in the study region), seasonal migration is a highly temporal issue since it traditionally only occurs during the dry season, in many households the labour force of the migrants is not needed due to a lack of dry season farming opportunities. The geographical aspect can be the location of a household and the farming area in a certain agro-ecological zone, what also significantly determines the cultivation options. Furthermore, it may refer to the distance between the farm and the next market facility, which of course determines mainly an individual farmer's probability of engaging in cash-crop production. Deriving from Chaynov's (1966) highly influential household concept, it is indubitable that the demography of a household is a very strong determining factor for livelihood opportunities: e.g. the higher a household's dependency ratio (or in other words: the share of dependents which are usually defined as the persons who are too young, old or sick to contribute to a household's productive capacities), the less likely will be its possibilities to engage in

rather labour intensive livelihood opportunities (de Haan and Zoomers 2005:40-41; see also chapter V.2).

Chapter summary

In this chapter, a framework for the analysis of local livelihood adaptation processes based on the current livelihood literature was developed. As central element, livelihood adaptation and livelihood strategies are regarded as closely connected since adaptation is a response process towards certain trends and shocks (livelihood contexts) that require a readjustment, optimization or rearrangement of the livelihood strategies. These shocks and trends go beyond environmental (climate change, soil degradation, etc.) or economic changes (globalization, changing world market prices, etc.). Therefore, livelihood contexts are usually of a complex and very fluctuating nature, so that adaptation is rather a continuous than an ad-hoc process. Livelihood adaptation is based on the use of certain social, physical, natural, human and social assets or capital forms (livelihood platform), which are accessed via social institutions, social relations or organizations. The outcome of a livelihood process will be successful if more livelihood security can be achieved (for instance by earning higher cash incomes). The adequate analysis of local adaptation processes on the household level requires a 'deconstruction' of the concept of unitary household decision making as well as a consideration of certain structural factors a household is exposed to.

III Research design

The research for this thesis is mainly based on quantitative data as the major questions are closely associated with socio-economic, quantitative variables; e.g. wealth-indicators, dependency ratio, migration ratio, etc. The main data set was generated by a survey in the Ghanaian part of the Atankwidi catchment, located North of the street connecting Bolgatanga and Navrongo (see also map IV.1). This sub-catchment of the White Volta Basin was chosen for several reasons. First of all, the Atankwidi catchment has experienced a massive expansion of SGI within the last one-and-a-half decades. Furthermore, the specific area was already selected as a study area for several surveys, also within the scope of the GLOWA Volta Project. Due to time and financial constraints, the underlying sample of the survey for this thesis could thankfully be based on the survey sample of Julia Schindler's doctoral thesis, whose research focus is on the land use dynamics in the Atankwidi catchment.

The accordant simple random sampled survey is made up of 150 households comprising a total aggregated sample population of 1,003 people.[10] According to Levy and Lemeshow's (1999:74) equation for the determination of simple random sample sizes, this sample size guarantees a maximal relative difference of 8.325% of the true population value, a confidence level of 95% and an estimated share of households that are into SGI of about 35% (based on older studies). The underlying population number of the Ghanaian part of the Atankwidi catchment was estimated at 38,095 whereas an estimated proportion of 13.5% of the population - also based on older studies - with access to 'official' dam irrigation farming was already subtracted since dam irrigation households were not perceived as part of the relevant population. The most recent population data for the Atankwidi catchment is from census data from the year 2000 of the Ghana Statistical Services. At that time, the total number of people living in the accordant survey area was stated at 41,091 (including farm households with access to dam irrigation). Besides the subtraction of population shares with dam irrigation access, this official population number was multiplied with a population growth rate for the

[10] To guarantee a valid simple random sample, all households of the Atankwidi catchment were identified in a satellite image and accordingly listed. Based on this list, a random sample was drawn. For further details, see Schindler (2009:58-59).

time period between 2000 and 2007 that was estimated at 7.2 % (based on the five-year growth rate of 5.1% for the Kassena-Nankana District, which is one of the riparian districts of the catchment (GSS 2002; information provided by the Kassena-Nankana District Assembly)). The actual survey was conducted in May 2007 in order to guarantee that the respondents remember the relevant dry season related information concerning irrigation farming and/ or seasonal migration.

To get a broader picture on the topics of SGI history and the significance of (seasonal) migration among irrigation and non-irrigation households, the sample was extended by 40 households, partly located in the communities of Doba and Pungu and in their majority associated with irrigation farming. These communities belong to the neighbouring Anayare catchment also being a part of the White Volta Basin. Especially Pungu is said to be the originating point of SGI in the area. These additional 40 households were sampled with a snowball approach; that is why these households are only used for purely descriptive issues. For any kind of inferential statistics related analysis, only the 150 randomly sampled households were used accordingly.

Moreover, the data from two SGI surveys, which have been conducted within the scope of the GLOWA Volta Projectin the years 2006 and 2008, were used. These two surveys have a total sample size of 213 irrigation households each, which also were randomly sampled among irrigation farmers of the communities Kandiga, Sumbrungu, Doba, Pungu and Mirigu among the Anayare and the Atankwidi catchment. They were particularly used to gather statistically sound information concerning irrigation household specifics and to describe certain developments and trends, which occurred over the two years between the conduction of the two surveys. Both surveys were conducted at the end of the dry season and the beginning of the rainy season in order to gather the recent dry season farming related information.

In addition to quantitative data, qualitative research methods were applied to gather some insights into the motivations and conveniences of seasonal migrants and irrigation farmers. About 40 semi-structured interviews with seasonal migrants, who at the time the interviews were conducted, quite recently returned to their home communities, were held. Within the survey of May 2007, also qualitative questions concerning the farmers' attitude concerning migration, their own migration histories and motivational situation and attitude towards dry season irrigation farming were integrated. Appropriate survey

questions were prepared with the help of several dozens of semi-structured interviews with the farmers in both catchment areas. Additionally, around 20 semi-structured interviews with farmers who were among the first ones to do SGI in their accordant areas were conducted in order to gain a deeper insight into the dynamics of spread of SGI.

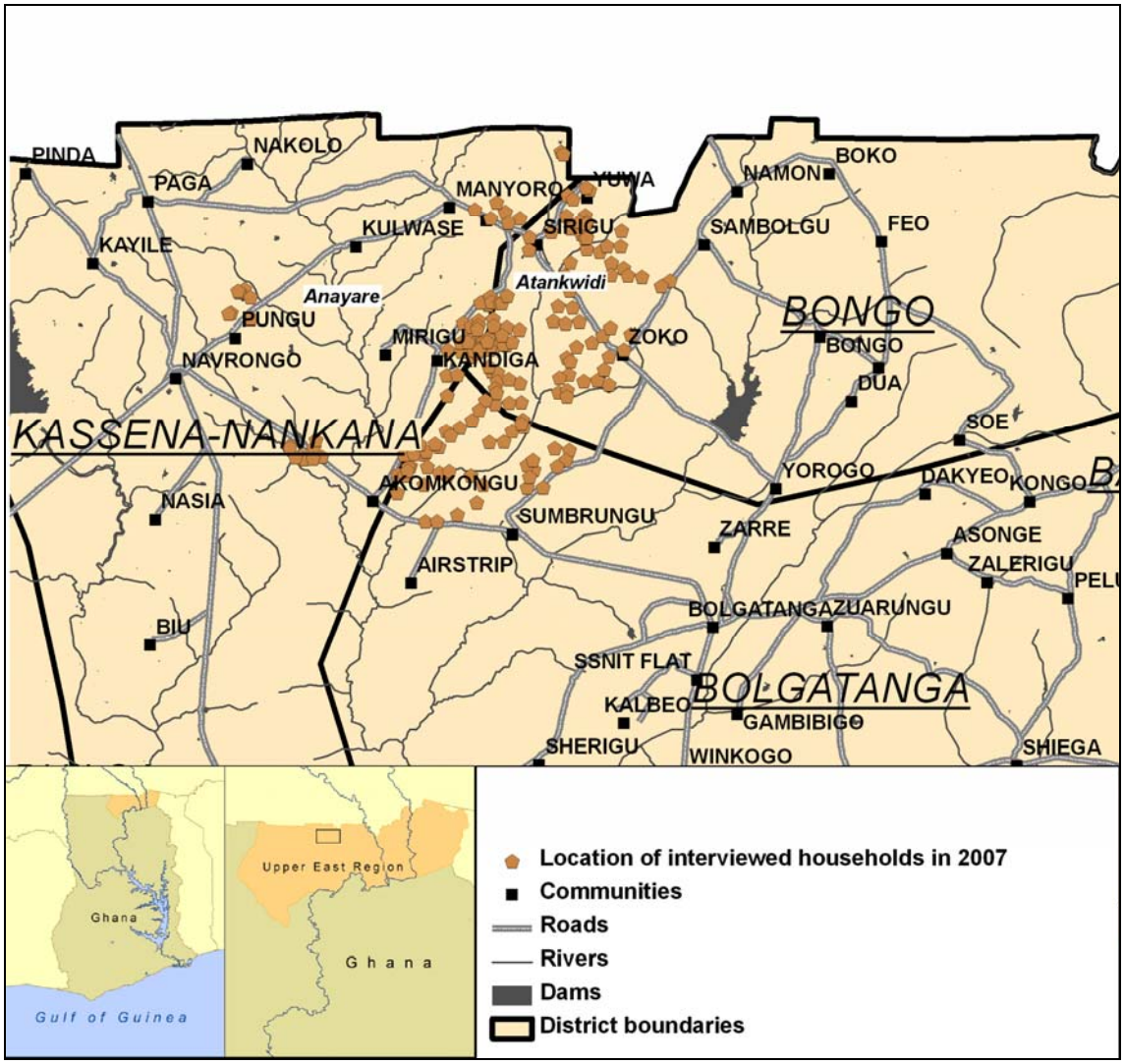
Finally, also spatial data as well as hydrological data were integrated into the research agenda for explorative reasons. To have some of the major research results confirmed, also a focus group discussion among farmers - both irrigation and non-irrigation - was conducted.

IV The study region

The Upper East Region, entirely part of the White Volta Basin, is located in the very North-East of Ghana and covers an area of about 8,800 km². The region contains the eight districts Bawku Municipality District, Bawku West District, Garu Tempane District, Talensi-Nabdam District, Bongo District, Bolgatanga Municipality, Kassena-Nakana District and Builsa District. The Upper East Region has a direct border to Burkina Faso in the North and a direct border to Togo in the region's East. The concrete study region is mainly belonging to the Atankwidi and to smaller parts also to the Anayare catchment areas, both sub-catchements of the White Volta basin. The area is located in the border region of the three Upper East Region districts of Kassena-Nankana District, Bongo District and the Bolgatanga Municipality (see map IV.1). The Kassena-Nankana District covers a total area of nearly 1,700 km², the Bongo district about 490 km² and the Bolgatanga municipality an area of roughly 1,460 km².

The following chapter will give an overview on the study area and its economic, social, and environmental characteristics, which can be perceived as part of the local livelihood trends. The first section is about how the study area is affected by processes of environmental change and how the local population pressure and the local agricultural practices are interfering with that. Furthermore, also the impact of labour migration and other traditional adaptive and coping strategies on the local livelihoods are being analyzed. Although 'designed' already a long time back in the times of the British colonial rule, the local population - as it will be furthermore described - has adopted (seasonal) labour migration as a solid and traditional standard tool to ensure food security, which was often an important adaptive or coping measure to overcome catastrophic events, such as droughts or epidemics. But also reciprocal solidarity among the people in the study area has helped and still helps to cope with such events. Correspondingly, the patters of social organization as platforms for adaptive measures will be described in the last section of this chapter.

Map IV.1: The study region



Source: own presentation

IV.1 Population and environmental pressure and its interference with the local peasant agriculture

Excursus: environmental degradation versus 'lie of the land'?

Not only patterns of global climate change have raised an intensive discussion on human-induced environmental change; also human activities on local levels and their possible implications for environmental degradation and decreasing harvest amounts were always a subject of scientific or political debates. Therefore, they are of a special importance for the adaptation of livelihoods. For decades, the contradictions between the theories of Malthus (1798) and Boserup (1965) confronted each other. Malthus' considerations were based on the assumption that population growth without extreme events, such as wars or epidemics, is always exponential while agricultural food production can only grow linearly. The predicted consequences of Malthus' assumption - and later on in the so called Neo-Malthusian adaptation - are ever increasing poverty, an overexploitation of natural resources and thus environmental degradation, rural exodus and hunger. Boserup (1965) developed a counter draft with the core statement that when agricultural production facilities become pressurized by high population growth, agricultural producers will find innovative ways to deal with that pressure, for instance with the shortening of fallow season, innovative cultivation methods, increased labour force, etc. The state of the art in this question seems to be that the alleged controversy between the two positions on the nexus between population density and agricultural growth is not that harsh any longer. A couple of studies (Demont et al. 2007; Pender et al. 1999) show that obviously both Neo-Malthusian as well as Boserupian effects to the one or the other degree always coexist.

With regard to Africa, a discussion on soil degradation and its linkages with agricultural practices came up in the last two decades, whose contrary point of views Koning and Smaling (2005) condensed as 'environmental crisis versus lie of the land' (Koning and Smaling 2005:3).[11] Already in the 1930s, concerns concerning soil degradation emerged, which were based on (Neo-) Malthusian considerations and therefore mainly blamed population growth and local agricultural practices for causing degradation

[11] The term "lie of the land" was originally introduced by Leach and Mearns (1996).

processes. These concerns made colonial administrations in Africa implement a couple of environmental and soil protection policies; e.g. the prohibition of bushfires or certain cultivation techniques. Several historical studies (Mackenzie 1998; Rocheleau 1995; Anderson 1984) clearly show that the underlying 'stories' of environmental degradation were - besides general ecological concerns caused by a couple of severe dust storms in the USA - motivated by local colonial officers or European commercial farmers as strategy of distraction and legitimization for land approbation or forced labour policies. Many of these colonial as well as early post-colonial policy interventions with the aim to prevent soil degradation were rather unsuccessful and caused resistance by local farmers. It can even be assumed that these policies significantly contributed to the establishment of national independence movements in many parts of colonial Africa (Mackenzie 1998). Nevertheless, the scepticism on soil and environmental degradation for Africa as a whole and its possibly catastrophic consequences for millions of peoples' livelihoods did not only continue but even worsened during the 1970s and 1980s; partly as a result of the great Sahelian droughts during that time (Meadows et al. 1972; Stoorvogel and Smaling 1990; Lal 1988).

In the 1990s, severe criticism by a couple of ecologists and social scientists appeared - who in their majority worked with livelihood or participatory approaches - concerning the pessimistic or alarming tenor of these studies. Critical publications of Behnke and Scoones (1993), Fairhead and Leach (1996) or Batterbury and Bebbington (1999) widely share some central arguments of critique, according to which many of the agronomic studies mentioned contain too much speculation and illegitimate up-scaling and interpolations of locally surveyed data and a discounting of temporal and spatial variability concerning many farming techniques in Sub-Saharan Africa. Two of their major arguments are furthermore that soil degradation is (a) a process that not necessarily leads to declining yields, and (b) is mostly a very local and temporal process, which does not allow a simple exaggeration or future trend prediction.

Koning and Smaling (2005:3-5) furthermore point out:

- that soil degradation is in general a gradual process, which usually is a result of complex interplays of different human- and non-human-induced in- and output-processes (see also table IV.1)
- that there is also no clear empirical base for a direct link between soil fertility decline and increasing population pressure. Farmers indeed may start investing in soil recovery measures when population increases, which in some (favoured) areas of Sub-Saharan Africa has led to u-shape kind of relation between population growth and soil fertility levels.
- that local knowledge of the farmers is so far an underestimated variable in the debate on the farming-population-land nexus.

On the contrary, Koning and Smaling (2005:5-7) clearly underline that a majority of soils in Sub-Saharan Africa are inherently poor by citing several case studies (e.g. Vlek 1990; Swift et. al 1994; Bationo et al. 1998), which clearly show that under continuous cultivation without larger external inputs, soil fertility levels are decreasing and yields are declining.

Table IV.1: In- and output processes affecting the soil nutrient balance and some selected Sub-Saharan African agricultural systems with their most important nutrient flows

Input 1	Application of mineral fertilizers and amendments, such as rock phosphates and lime
Input 2	Application of organic fertilizers, such as household waste, manure, or (indirectly) concentrates fed to livestock
Input 3	Atmospheric deposition
Input 4	Biological fixation of nitrogen
Input 5	Sedimentation through irrigation or accumulation of eroded materials
Output 1	Removal of nutrients in harvested products (grains, tubers, animal products)
Output 2	Removal of crop residues and nutrients contained within them
Output 3	Leaching of nutrients beyond the root zone
Output 4	Gaseous losses of N and S (denitrification, volatilization, burning)
Output 5	Wind and water erosion

Agricultural system	**Major agricultural activities**	**Nutrient stocks**	**Important nutrient flows**
Irrigation	Rice, maize, horticulture	High	IN 1; 4; 5; OUT1 ;2; 3; 4
Rift valley	Teff, wheat, maize, tea, coffee, livestock (penned)	Medium	IN 1; 2; OUT 1; 2; 3; 5
Sudan Savannah	Sorghum, millet, cowpea, groundnut, livestock (free-range)	Low	IN 2; 3; 4; OUT 2; 5
Forest frontier	Cassava, sweet potato, cacao	Low	OUT 3
peri-urban	Horticulture, floriculture, small livestock	Medium	IN 1; 2; OUT 1; 2

Source: Koning and Smaling (2005: 6); the sum of outputs minus the sum of inputs indicates whether soil fertility is increasing, stable or decreasing.

As a conclusion and way forward, Koning and Smaling (2005) suggest that it is necessary to adopt an area-specific but holistic perception, which especially includes economic developments and circumstances. This is absolutely necessary in order to analyze the complex interwoven linkages of population growth, soil fertility and agricultural practices. The authors furthermore point out that in particular prices and market opportunities play a major role in this context. Several studies (e.g. Amanor 1993; Tiffen et al. 1994; Koning et al. 2001) show that favourable economic conditions like good marketing opportunities for certain agricultural commodities promote agricultural intensification, a trend towards more commercial agriculture and investments in soil recreation measures. Vice versa, in places where market conditions were unfavourable (e.g. world market prices were low) and a horizontal expansion of agricultural expansion under conditions of population growth are not possible, soil degradation is likely to occur.

Processes of environmental change and the local agriculture in the study region

The major part of Northern Ghana including the Upper East Region belongs to the West-African semi-arid Guinea Savannah belt with the exception of a small swath of land in the very North-East part of the region around Bawku that belongs to the Sudan Savannah (Adu 1972). The standard 'climatic year' can be divided into two seasons: the dry season from November to April/ May with only marginal rainfalls and the wet season from June to October. The amounts of rainfall in Northern Ghana vary quite substantially according to the location: in most parts of the Upper East Region for instance it varies from 1,000 up to 1,300 mm per annum - in some parts even less - (Kranjac-Berisavljevic et al. 1999:5). Most of the precipitation (about 60 %) normally can be expected in the time period from July until September when the mean annual temperature has an average of 28.6 C. In March and April, usually the hottest months at the end of the dry season (Kranjac-Berisavljevic et al. 1999:5-7), the average temperature is more than 32°C.

According to interviews being made with North-Ghanaian farmers, within the last decades the number of years increased when the onset of the rainy season has shifted from late April or early May to June or in very extreme cases even up to early July (see

also Laube 2007:45). This increasing variability of rainfall patterns is a serious problem for farmers as it creates a considerable uncertainty concerning the right time to start the sowing process; if the seeds do not get enough rain water after the sowing, the crop most-likely will die long before it has reached its full blossom This in turn can mean crop failure and increasing food insecurity. Farmers report that the traditional signs for the onset of the rainy season (like certain behaviour of birds and ants, changing wind patterns, the coming of new leaves, etc.) have become unreliable nowadays (see also Dietz et al. 2004:159). Climate models for the region come to the conclusion that the already experienced shifting in the onset of the rainy season will further increase in the next decades. As a result, it could turn out to be normal in Northern Ghana that the first rains of the rainy season will not set in before the month of June or even later (Jung and Kunstmann 2007, see figure IV.1). For Northern Ghana, Laux (2009:130;181) estimated that the onset of the rainy season for the Sub-region of Northern Ghana and Southern Burkina Faso may shift from the average 140th Juilan day of the year (estimated for the time period 1961-2000) to up to the 171st Julian day of the year in average (estimated for the time period 2001-2040); also the standard deviation for the onset of the rainy season will increase, which means that the onset will not only shift but will become even more 'erratic'.

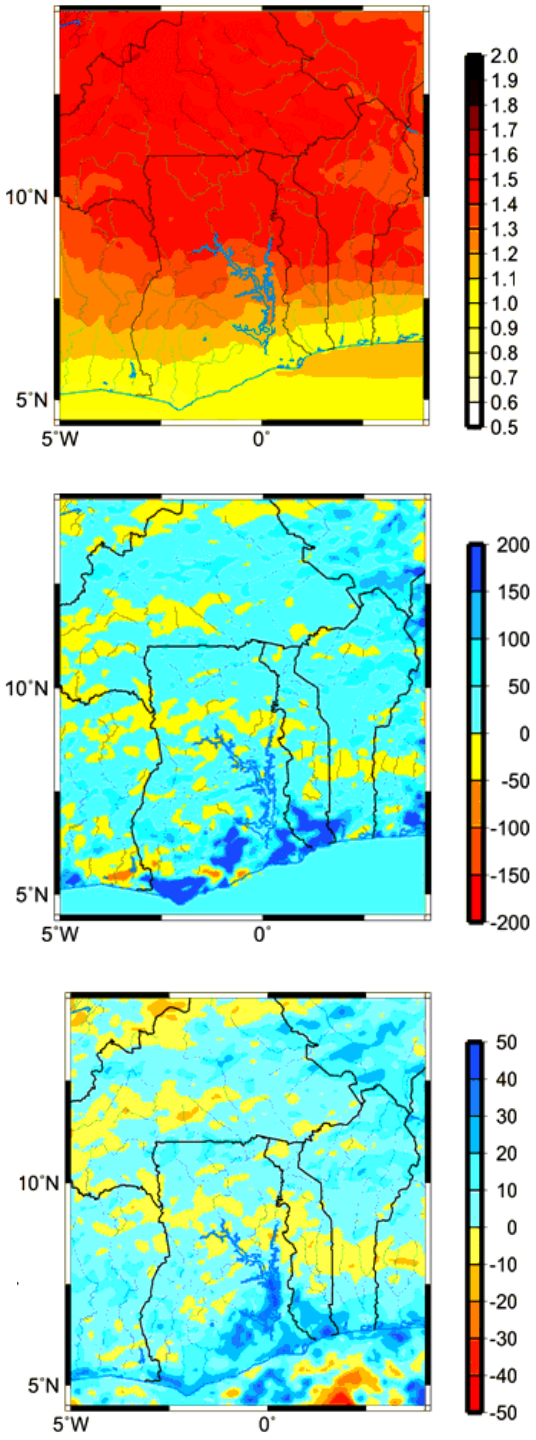
In a long-term perspective, also the rainfall amounts in wide parts of West Africa have changed: for the period of 1970 until the beginning of the 21st century the decrease rate of the mean annual rainfall ranged from about 10% for the wet tropical zone to more than 30% for the Sahelian zone (Niasse 2005:4). For the whole Volta Basin, the mean precipitation amount decreased by 10% from 1,100 mm per year in the time span 1901-1969 to 987 mm per year in the time period 1970-2002. Especially the period between the late 1970s and the late 1980s was a decade with very severe droughts that in particular affected West-Africa and the whole Sahel region. On the other hand, a clear increase of the rainfall amounts since the late 1980s and early 1990s can be observed; this is the reason why some authors interpret the rainfall trends during the 1970s and 1980s rather as major climate deterioration than as indicator for a process of long-ranging climate change (Dietz et al. 2004:154-157). Climate predictions correspondingly do not see any significant changes in rain fall amounts for the next decades (despite of an assumed shortening of future rainy seasons). However, the

reduced rainfall amounts during the 1970s and early 1980s had for the Savannah regions of Ghana the major consequence that the degree of river flow in the wet season and the number of small pools along the riversides has been reduced significantly since then (Oguntunde et al. 2006:1187; Dietz et al 2004:159).

Besides the changing rainfall characteristics, a significant increase of the mean temperatures in the region for the time period of 1961 until 1990 compared to the time span of 1931 until 1960 could be observed (Kranjac-Berisavljevic et al. 1999:7-8). According to these findings, Gonzales (2001:222) concludes that the West-African Sahel as well as all savannah types south of it have shifted in southern direction during the second half of the 20th century for about 25-30 km. Climate models for the Volta Basin predict that the average temperatures in the Upper East Region for the decade of 2030-2039 will even further increase to up to 1.5°C in average as compared to the decade of 1991-2000. For the same decades compared, mean precipitation is expected to stagnate or to further decrease. A similar scenario can be anticipated for the surface runoff (see figure IV.1).

Climate change - in particular an increasing rainfall variability - obviously is a severe stressor for livelihood adaptation in the study region. But what can be said about local human factors leading to environmental degradation, in particular soil degradation? The rather light soils of the Upper East Region are principally less prone to soil erosion processes since the local soils are mainly underlain by different granite types and pyroclastic rocks compared to the soil types of the Northern Region, which are mainly underlain by sandstones. The latter are more exposed to hardpan and concretions (Runge-Metzger 1993). Nevertheless, Adu (1973) came already in the 1970s to the result that the process of soil degradation in all its different facets ranging from physical (erosion, ironpan formation, crusting) to chemical (loss of nutrients, acidification, salinity) and biological (depletion of organic matter) is very severe in Northern Ghana (and especially in the Upper East Region). Taking the same line, the Ghanaian Environmental Protection Agency (EPA) estimated that about 35% of Ghana's land area - in particular the whole North-Eastern part of Ghana - already are or will be affected by severe soil degradation processes to different degrees. In these predictions, the Upper East Region is expected to be one of the most affected areas with conceivably catastrophic impacts on the local population (EPA 2002:26-28).

Figure IV.1: Precipitation, temperature and surface runoff predictions for Northern Ghana 2030/2039-1991/2000

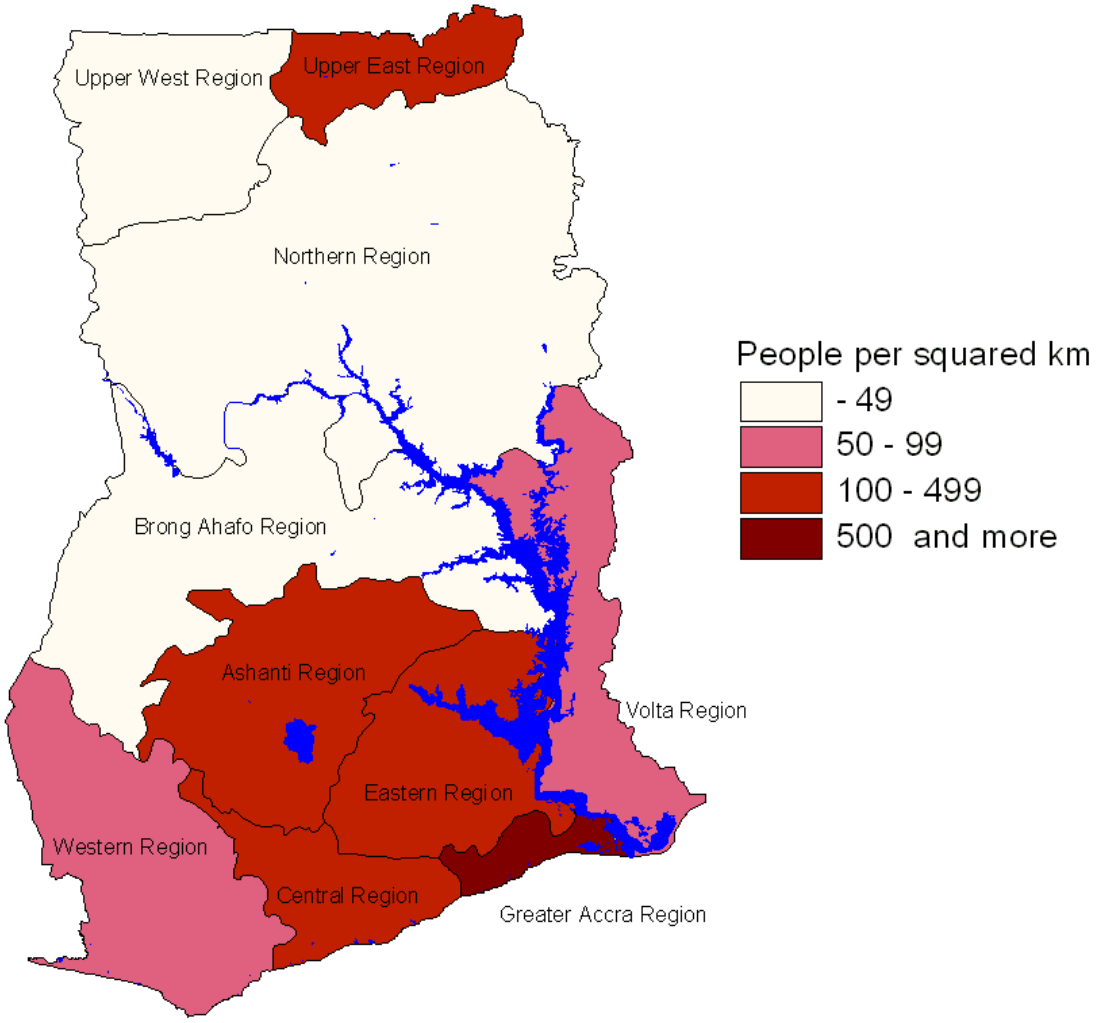


Source: Kunstmann and Jung (2005: 31)

In this context, the question has to be raised how severe these patterns of locally induced environmental degradation really are. Therefore, in the following - based on Smaling and Koning's (2005) conclusions on local environmental degradation - a precise analysis on the local population-environment-agriculture-nexus in Northern Ghana will be conducted.

Generally due to several historical and socio-economic reasons, the population is very unequally distributed across Ghana. While the South is very densely populated (especially in and around the big urban centres of Accra, Kumasi or Sekondi-Takoradi), Ghana's North is widely characterized by a rather low population density. But this does not apply to the Upper East Region since - as map IV.2 shows - the Upper East Region is the most densely populated region in Northern Ghana with a range of 91 to 104 persons per squared kilometre in the year 2000 - what even by far exceeds the national average population density of 79 people per squared kilometre. The neighbouring Upper West Region just has 31 and the Northern Region only has 26 people per squared kilometre (GSS 2002). Taking into consideration that according to GSS survey data (2002) only 15.7 % of the region's population live in urban areas and more than 80% are living in rural area (and are to some extent related to (subsistence) agriculture), the high population density for such a rural area is even more astonishing.

Map IV.2: Population density of Ghana (2000)



Source: own presentation, based on GSS (2002)

As table IV.2 shows, the population growth rate for overall Ghana amounts to 54% in the period of 1984-2000 while the population of the Upper East Region only grew by 19% during the same 16 years. The Kassena-Nankana District as a major abutting district of the Anayare and Atankwidi catchment had even a negative growth rate of 0.1% for the years 1984-2000. Consequently, these facts strongly indicate that the migration rates to Southern Ghana, especially the ones of the younger population, are very high; although this is not a necessary indicator for a Malthusan rural exodus (for a detailed description of the migration development in the region, see the following next sub-chapters).

Table IV.2: Population dynamics in Ghana, Upper East Region and Kassena-Nankana District 1960 - 2000

		Ghana	Upper East Region	Kassena Nankana District
Population	1960	6,728,815	468,638	93,397
	1970	8,559,313	542,858	99,006
	1984	12,296,081	772,774	149,680
	2000	18,912,079	920,089	149,491
Growth rate (%)	1960-70	27.2	15.8	6.0
	1972-84	43.7	42.3	51.0
	1984-00	53.8	19.1	-0.1

Source: GSS 1989, 2002

However, the high population density and the related human activities are to a high degree reflected in the region's landscape; areas once covered with forests more and more disappeared, which was mainly caused by the extension of agricultural areas and bushfires (Blench 2006a:5). According to Codjoe (2004:181), from 1990 till 2000 it is estimated that the land area covered by forests in the Kassena-Nankana District for instance has gone down from 294 km² to 152 km², i.e. a decrease of 48%. For the whole Ghanaian part of the White Volta Basin, the decline of land areas covered by forests is with 71% (from 4891 km² to 1408 km²) in the same period much higher (see table IV.3).

Table IV.3: Changes of forest covered land areas in the time period from 1990 till 2000 in selected districts of the Ghanaian White Volta Basin

	Land area covered by forests in 1990 (in km²)	Land area covered by forests in 2000 (in km²)	Change in km²	Change in %
Bongo District	32	30	-2	-6.3
Bolgatanga District	688	181	-507	-73.7
Kassena Nankana District	294	152	-142	-48.3
Whole Ghanaian part of the White Volta Basin	4,891	1,408	-3,483	-71.2

Source: own presentation, computed from Codjoe 2004: 181.

These high rates of deforestation remain quite doubtful as other studies show lot less deforestation in the region. For two larger study regions around the villages of Sekoti and Tiogo (both Upper East Region), Wardell et al (2003: 244) came to the result of a mere net-deforestation rate of about 3% for a time period of 15 years (1986-2001). Nevertheless, the regional tree flora itself has changed insofar as nowadays mainly tree species with an economic value like the shear nut tree (*Vitellaria paradoxa*) or the parkia tree (*Parkia biglobosa*) are dominant. There are hardly any 'natural' spots in the region left that do not show traces of human activities like free roaming farm animals, agricultural plots or housings (see Photo IV.1 for a typical human activity drawn landscape picture showing plots, compounds and fowls). But the Upper East Region is not a purely anthropogenic landscape; besides some few forest reserve areas, there are still some sacred groves attached to several villages in the region. In those areas, several mainly rare plant and animal species have found a niche to survive (Blench 2006a:5).

Photo IV.1: Typical anthropogenic landscape impression in the Upper East Region at the end of the dry season

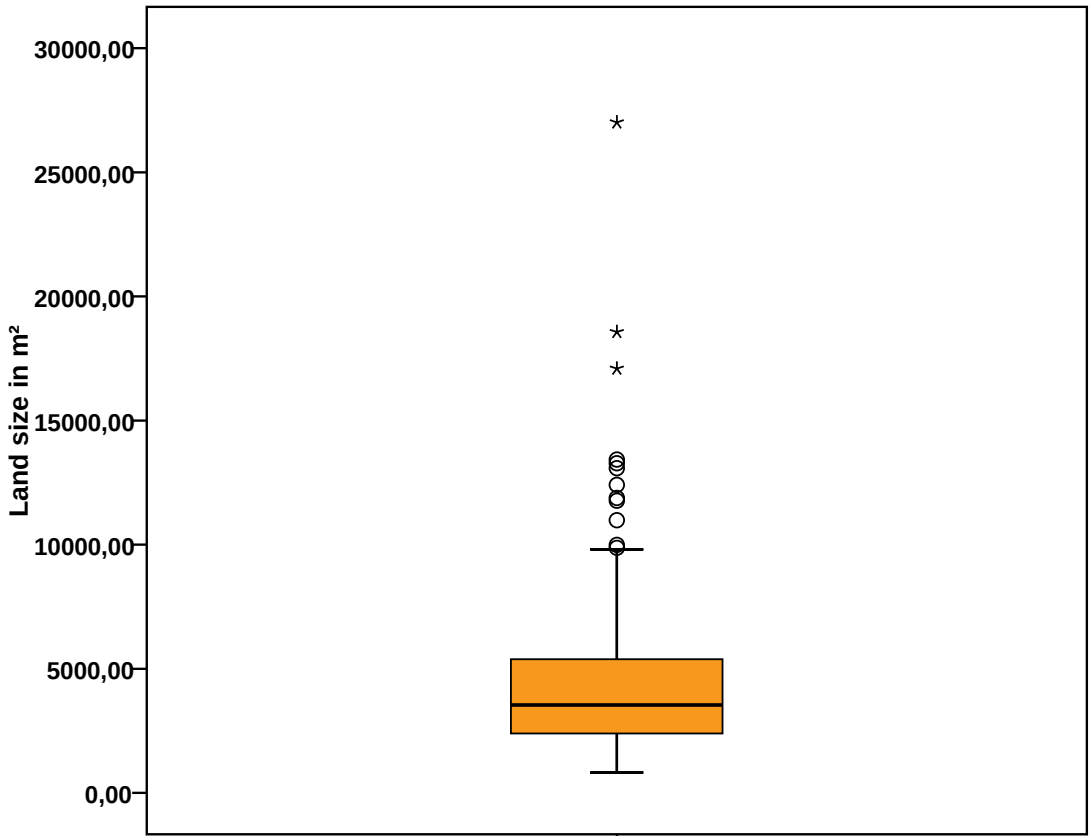
Source: own photo

With regard to peasant rain-fed agriculture, there are several indications that the high population pressure is reflected first of all in declining plot sizes within the last decades: in the farm season 2005/2006, the aggregated average land size farmed in the rainy season by peasant households in the study area was 4,798 m². The value for the mean land size of peasant farms in North Mamprusi area of (today's) Upper East Region in the 1930s was estimated by Lynn (1937; cited in Konings 1981:5) at more than 10,000 m² while estimations from the 1960s and 1970s for the same area still came to a value of about 8,000 m² (Konings 1981:5).[12] The declining mean aggregated farm size definitely bears witness to the high population density and the pressure it had induced for farming

[12] The values mentioned in the literature were originally quoted in acres.

over the years. As figure IV.2 shows, the range of the aggregated rainy season farm land can differ a lot among the households; some farm households (mainly single person households) cultivate only a few dozen square meters in the rainy season while other households may cultivate up to more than 20,000 m².

Figure IV.2: Aggregated rainy season land size of farm households in the study region



Source: own presentation, based on data provided by Julia Schindler

The traditional farming system is shifting or fallow cultivation: originally, a particular plot was farmed for one or two rainy seasons; thereafter, the plot was under recovery for at least one farming season. Now, many plots are to an increasing degree cultivated permanently and therefore fallow seasons, in which soil quality can recover, hardly exist anymore.

Three different kinds of rainy season farm lands need to be distinguished: compound land, family land, and bush land whereas the family land is usually of least importance

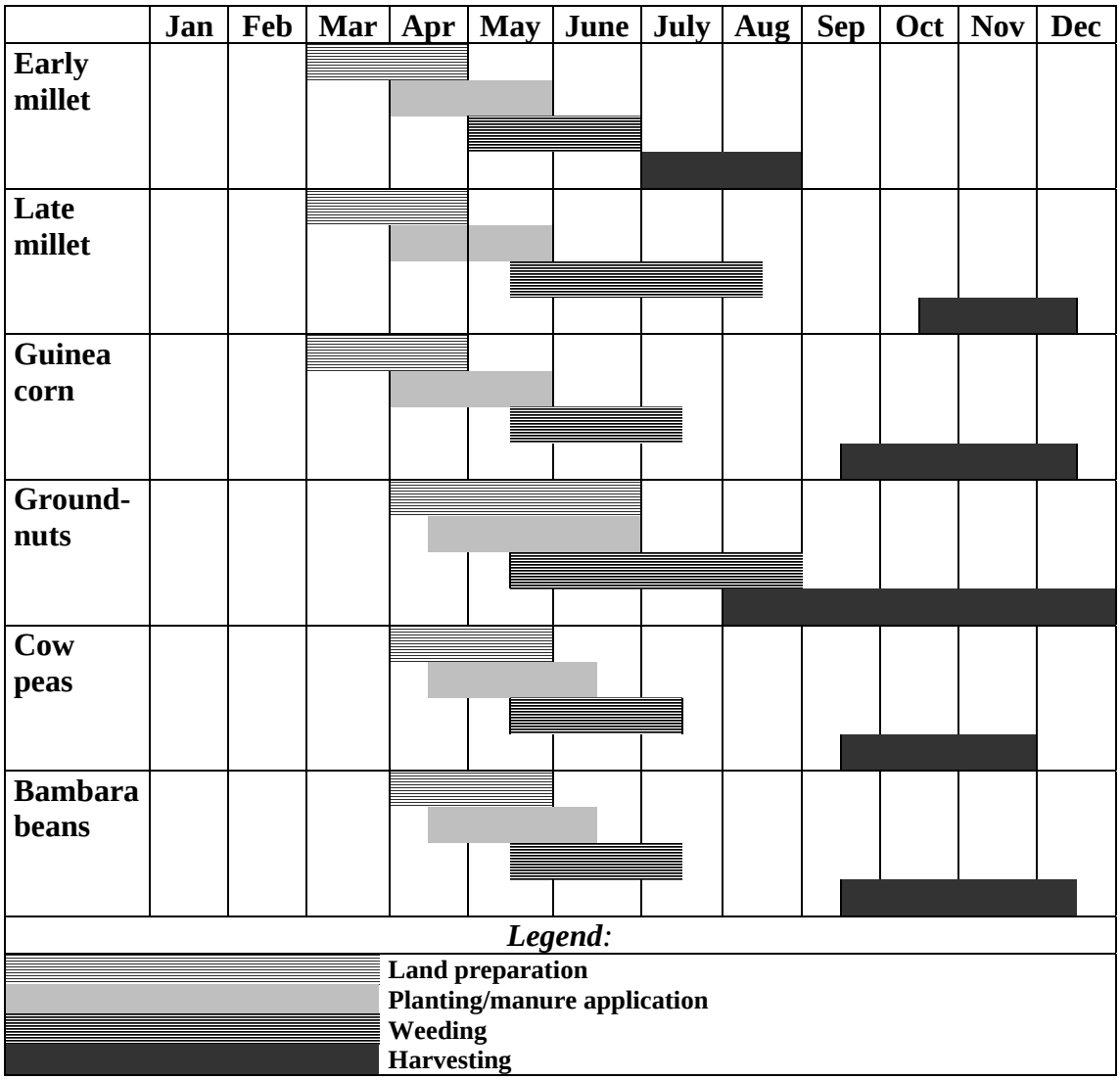
in this context (Benneh 1973; Laube 2007:151-160). The compound land is farming land that is located closely around the farm compound. Especially the permanent cultivation of compound farm plots is very common throughout the research area. The control of these plots is incumbent for the family head, who can also share this control with other members of their compounds. Compound land is inherited in the patrilineage, but it can laterally be inherited by the accordant next senior member. This land type is usually not divided after the death of the former owner. The increasing population within the last decades has caused the conversion of many bush farms to compound farms (Dietz et al. 2004:151; the land allocation practices for family and bush land are described in chapter V.2).

Rain-fed peasant agriculture in North-Eastern Ghana is particularly based on the cultivation of millet. The millet cultivation is usually made up of two varieties: a short-season variety (better known as early millet), which is usually harvested in July, and a long-season cultivation (better known as late millet) that is ordinarily harvested in November. The early millet is mainly cultivated at the compound plot(s) - because they have a higher fertility - and it is widely intercropped either with late millet, guinea corn or sorghum, whilst the late millet varieties are according to Dietz et al. (2004:159) increasingly on the decrease. The remaining family or bush plots are oftentimes cultivated with an intercrop mixture of sorghum and pulse crops (mainly cowpeas and groundnuts) (Blench 2006b:9). Konings (1981:6) has emphasized that in the early 1980s the rising population pressure has induced an increased adoption of mixed cropping cultivation methods, which have partly contributed to slightly mitigate the effects of declining soil fertility and therefore to passably maintain harvest security levels. Early and late millet are usually intercropped with each other, but also the intercropping of a millet variety with groundnuts, cowpeas or guinea corn is very common (see figure IV.3 for an temporal overview of cultivation periods for each of the crops). A small part of the compound land is oftentimes cultivated by the women of the compound, who use the section of the land as compound gardens, where additional soup ingredients like tomatoes and other vegetables like okra are grown. Small pieces of the compound plots may also be used by the men to cultivate some tobacco for their own consumption needs. The fertilizer that is used for these plots is mainly manure but also human waste, which is collected by the household members and then being put on the cultivation area.

Besides this 'traditional' fertilizer, the equipment used in the North-Ghanaian peasant agriculture is still on a very low technological level and mainly made up of hoes, cutlasses and - more rarely - bullock ploughs reflecting the high poverty rate in the area (Laube 2007:151-156). The uptake of the last mentioned is even quite a recent development: bullock ploughs were first introduced in the 1940s. But these were not widely spread in the study area before the late 1970s and early 1980s (Webber 1996:442-443). Although tractors are meanwhile commonly used in the commercial (irrigation) agriculture of the region, they are hardly found in peasant plots (Laube 2007:165); the same applies to other kinds of agricultural machinery.

Moving on to the question of how agricultural practice is affecting soil fertility levels; in their recent studies, Kpongor (2007:37-41,) who did a case study in the community of Pungu (part of the Anayare catchement), as well as Braimoh and Vlek (2005:362-364), who did a survey and a GIS-based analysis of a 4,800 km² area in the Northern Region, come to the result that in Northern Ghana the areas under permanent cultivation are especially exposed to soil deterioration. Similar to Koning and Smaling (2005), Braimoh and Vlek (2005) emphasize the role of macro-economic conditions for the land-population growth-degradation nexus. In particular, they come to the result that the devaluation and the removal of subsidies in the 1980s under conditions of increasing population growth (see also chapter IV.2) were important drivers for an intensified agricultural cultivation and in consequence also contributed to an increasing depletion of soil nutrient levels of many farm plots in Northern Ghana. This especially refers to farm lands in the already densely populated areas of Northern Ghana (like wide parts of the Upper East Region); in the less populated areas, agricultural extensification and cultivation of land close to market and road accesses are typical responses to population increase. But even for the densely populated Upper East Region, one cannot generalize degradation trends: Kpongor (2007:37-41) found that in particular bush farm plots in contrast to compound farm plots are rather exposed to degradation processes due to a lack of manure application .

Figure IV.3: Cropping calendar for peasant rainy season farming in Northern Ghana



Source: own presentation, based on Laube (2007:165)

But the problem of declining soil fertility in some areas worsens due to bushfires (Blench 2006a:5; Kpongor 2007:41). Since the 1980s, a couple of policy measures were implemented to curb the dangers of wild bushfires that have had fatal effects for the local population in the late 1970s and early 1980s (especially) in Northern Ghana. But all those efforts to go back to the strict non-burn policies of the colonial times - which met heavy resistance at that time - could not eradicate the bushfire problem completely (Amanor 2004). Strong patterns of overgrazing have similarly depleting effects on the already poor soils of the area as the fertility and the content of organic matter of soils is

decreasing and erosion is diminishing the depth of soils (Kranjac-Brisavljevic et al. 1999:15). In addition to local cattle, during the dry seasons a vast number of Fulani herdsmen bring their cattle to Northern Ghana and are massively contributing to the problem of overgrazing. The resulting feeding shortages in the region have according to Dietz et al. (2004:156) led to the situation that local farmers are more and more going over to keep sheep or goats instead of cows due to the goats' sheep' smaller demand for stems or grass than cows. Furthermore, the return of nutrients to the soil is limited due to the regular removal of stem cereals as a result of lacking firewood (Blench 2006a:5). Another significant factor that reduces the nutrient recovery of many soils is the conventional practice that farm animals cannot roam freely on the farming areas during the rainy season in order to prevent them from destroying the crops, which of course reduces the manure supply to the related soils (Laube 2007:213; Blench 2006a:5). As a consequence, organic matters do not trickle down to the soils and the respective farm cultivation areas are increasingly exposed to erosion processes (Blench 2006:5). However, farmers in the study region have in recent years developed 'smaller' adaptation means like the application of green manure from legumes, rice bunding or alternative composting measures in order to counteract erosion processes for sustaining food crop production (Derbile 2009:21).

As already mentioned, the local food crop production (and thus also the local household's major food stockpile) is mainly based on millet, which as well as the guinea corn has an important spiritual value for certain ceremonies and sacrifices. As figure IV.3 shows, the harvesting time of rainy season farming ends at the latest in December. By that time, the bulk of the household's food supply is harvested and is stored usually at the compound's granary. Depending on the amount of cereals that have been harvested, the so called 'lean season' sets in from January and February in the accordant following year. This means that the members of the household have to take care of their food stocks as those have to last until the first cereals of the new rainy season are harvested again to refill the compound's granary (usually the early millet harvest is in July and August). As a result, the calories supply of farm household members may drop drastically during that time, in particular as a consequence of harvest failure, e.g. due to rainfall unreliability. Accordingly, hunger and malnutrition may be the order of the day; especially in March and April when the workload attached

to the preparation of the rainy season farming with such tasks as land clearing and sowing is the highest (Destombes 2005).

To overcome or at least to mitigate food shortages, the North Ghanaian peasants have always kept several kinds of livestock and smaller animals, such as cattle, sheep, goats, chicken and guinea-fowls. Livestock and small animal possession is largely regarded as an insurance investment and ex ante coping strategy as in times of a sudden need it can provide food for the household consumption or for important social events, which in Northern Ghana are first of all funerals. According to the findings of the 2007 survey, the households in the study region spend more than 1,000,000 old Cedis averagely for the performance of funerals, which are usually being celebrated at the end of the dry season. But livestock in the study region as well as in many other peasant societies in Africa and elsewhere also functions as some kind of a peasant stock investment because it can bring in 'hard cash' in times of need. Moreover, livestock and in particular cattle are of a very high cultural meaning for peasants in the study region: they symbolize the social status of a farmer and particularly cows are also very commonly used in wide parts of Northern Ghana to pay the bridal dowry (Tonah 1993:63-64). Just as compound land, livestock is usually inherited in the patrilineage. Table IV.4 shows that predominantly guinea fowls, chicken, donkeys and goats are widely possessed animals.

Table IV.4: Descriptive statistics for the possession of livestock per household in the Atankwidi catchment (2007)

	Mean number	Std. Deviation
Bullocks	2.1	0.6
Cows	3.8	2.5
Donkeys	2.0	1.1
Goats	5.2	2.7
Sheep	4.2	2.8
Guinea fowls	10.0	6.4
Chicken	9.9	5.9

Source: own computation, n=150 (Atankwidi data)

Besides keeping livestock, a high range of off-farm activities is to an increasing degree part of the livelihood portfolios of North-Ghanaian peasant households in order to generate additional income channels - primarily to buy further groceries but also to meet other expenditures like clothing or school fees. Depending on the location or market environment, social status and the agricultural income situation, off-farm activities range from the collection of firewood or other tree and field products to food processing like the brewing of *pito*[13] or small-scale trading activities. In some communities in the study area, also traditional crafts like the weaving of baskets, pottery or the making of special ropes for animal husbandry were established as considerable sources of additional income (Laube 2007:216-223; Konings 1981:7).

Concluding, the primary ecological stresses for small-scale farmers in Northern Ghana derive from a most-likely further increasing rainfall variability. In consequence, there is a trend to higher harvest insecurity risks in turn increasing the danger of higher food insecurity. Soil degradation is also a problem in many farming sites of the study region, mainly due to the poor soil fertility levels. Despite its high population pressure, it cannot be classified as a general problem of the study region.

IV.2 Labour migration as a traditional coping strategy and its interference with regional underdevelopment

Compared to the rest of the country, the degree of poverty and underdevelopment in rural Northern Ghana is severe. Based on the results of the Ghana Living Standard Survey (GLSS) IV, which was conducted in 1998/1999, the share of the population of the Northern rural savannah areas living below the headcount poverty line is at almost 70%[14] compared to less than 50% of the population in the Southern forest areas of Ghana (Coulumbe 2005:8). The underdevelopment of the three Northern regions is apparent in diverse domains. The health infrastructure in Northern Ghana is very poor. In the Kassena-Nankana District for instance, one hospital and eight small health centres exist but only two medical practitioners are working in the hospital - and

[13] Pito is a North-Ghanaian millet beer.
[14] For the three districts which are partly belonging to the study area, the numbers for the share of the rural population living below the poverty line are as follows: Bongo District 70.6%, Bolgatanga Municipality District 64.7% and Kassena-Nankana Distrcit 61.1% (Coulumbe 2005:26-27).

usually, only one is on duty. De facto, this means that approximately 150,000 people living in this district share one doctor. The poor condition of health services also is reflected in a low life expectancy of about 52.6 years at birth for the Kassena-Nankana District (Nyarko et al. 2002:7) compared to the overall life expectancy for Ghana, which is estimated at about 57 years at birth (CIA 2008; UNDP 2009:173). But also concerning other issues, such as infrastructure, electrification, sanitation, housing situation or school education, Northern Ghana stays behind the Southern parts of the country. A UNDP case study of the West Gonja District in the Northern Region indicates that about 45% of the total adult population in the district is illiterate, i.e. about 10 percentage points above the national average (UNDP 2007:53; UNDP 2009:169). Furthermore, 89% of all buildings in the Kassena-Nankana District are for example mud buildings with thatched roofs. The school attendance with just 51% among the age group of the 6 - 25 years old is comparably very low (Nyarko et. al 2002:7).

As the following sub-chapter will show, underdevelopment and poverty in Northern Ghana have their roots in the colonial time and are closely interwoven with the history of (seasonal) labour migration from Northern to Southern Ghana. Besides, migration patters have always been adopted as a valuable coping and adaptation strategy tool by the local population in times of extreme events, such as epidemics, droughts, food shortages, etc.

Migration and population mobility in Ghana is a phenomenon that goes back to pre-colonial times. Besides the tribal movements as former basis for today's ethnic diversity in the Upper East Region, self-employed traders were bringing goods like ivory, kola nuts, livestock or clothes to the territory forming today's Northern Ghana. In particular the market of Salaga (today Northern Region) was a magnet for those trade-driven migration movements as it was located at an important intersection of West-African trade routes in the 18th and the early 19th century (Anarfi et al. 2003:5). Slave trade and pre-colonial wars (see the following sub-chapter) initiated particularly in the 19th century a lot of forced population movements in the Northern part of present-day Ghana. An important form of migration in the second half of the 19th century - but still without strong influences of the establishing British colonial rule - was the migration of farmers, mainly coming from the Southern part of the Gold Coast colony. Due to land

shortages in their home regions, they went to the rather sparsely populated areas in the Southern-central part of the Gold Coast territory. Additionally, the fast growing gold mining sector in the late 19th century began to attract more and more workers from neighbouring regions and above.

However, the intrinsic roots of the development of internal labour migration in Ghana and correspondingly also the roots of the existing underdevelopment of North Ghana have their origin in the economic developments in the Southern part of the Ashanti Protectorate and the Gold Coast colony in the late 19th and early 20th century.[15] Mainly for power-political reasons, the so called Northern Territories were finally annexed by the British in 1902 to forestall the colonial expansion of Germany and France in the region, which was widely devastated by slave trade and war (see chapter IV.3). A first expedition to the later Northern Territories had already taken place some years ago to assess the economic possibilities of the new territories. The head of the mission, George Ekem Ferguson, a geologist from the Fante area, came to the result that the Northern Territories with its population mainly made up of agro-pastoral subsistence-farmers could have some potential concerning gold mining or ivory trade; but the most important economic potential would definitely be of an agricultural nature. Ferguson suggested the expansion of the agricultural production in the North via an increased cultivation of millet, yams and shear butter. Those production patterns should be promoted with a further cultivation of tobacco, indigo and cotton cultivation; at the same time, the trade with the Southern part of the Ashanti/Gold Coast territories should be intensified. However, Ferguson underestimated the difficulties associated with such development perspectives as well as the colonial administration's willingness for accordant policy interventions. On the one hand, the traditional trading routes from the North to the South went through territories now belonging to the French or the German colonial empires; on the other hand, the colonial administration in the North was busy pacifying the Northern Territories as well establishing the British rule over the area in the very early 20th century (Sutton 1989:639). Serious development perspectives for the region were accordingly being put aside in the first days of colonial rule over the Northern Territories. The introduction of tolls for trade caravans crossing the area - as a

[15] In administrative terms, colonial Ghana was virtually triple-subdivided into the Gold Coast Colony, the Ashanti Protectorate and the Northern Territories.

sole base of making the Northern Territories a 'cash cow' - was quickly abolished. The fears that the tolls would discourage traders from transporting their goods through the Northern Territories to the Southern parts of the Gold Coast colony exceeded the profit prospects. As a consequence, large parts of the British colonial administration regarded the North as a 'wasteful possession' (Staniland 1975:44).

Something like an 'economic perspective' for the population of the Northern Territories developed in the form of forced labour as the Gold coast gold mining sector in pre-colonial Ghana was to an increasing extent benefiting from the stagnation in the South African gold sector due to the Boer War from 1899 until 1902. In consequence, the mines suffered from severe labour shortages in the very beginning of the 20th century, all the more as many (potential) Akan mine workers refused to work underground. In their traditional belief, subsurface work was associated with evil spirits and regarded as a low-status work that should be done by slaves. Furthermore, the Akan population could more or less easily earn their livelihoods with the cultivation of crops like yams, cocoa, cassava or bananas. For that reason, there was no real need for them to work in the mines (Anarfi et al. 2003:10). In 1905, the managers of a gold mine in Tarkwa made an inquiry to the colonial administration concerning the possibility of recruiting labourers from the Northern Territories. Although the Chief Commissioner A.E.G. Watherson was sceptical about this request, he agreed to initiate a 'labour crusade' in the Northern Territories. But he gave his consent only on condition that the men who would work in a certain mine should all come from the same village. Moreover, they should be able to contact their chiefs at any time and a colonial official should accompany them on their way to the South at least to Kumasi. In addition, Watherson argued that the chiefs would be hardly willing to let their young men go, especially during the rainy seasons. On the one hand, their labour force would be needed to work on the farms; and on the other hand, the chiefs would be afraid that the men could possibly not return. Despite those concerns, by the end of 1906, thirty men in Navrongo and Wa (today Upper West Region) were chosen by colonial officials to undertake an investigation trip to the mining areas in the South. They got to know the living and working conditions as well as the economic benefits and after some weeks they returned home to report about it. Later on, 26 young men, who were coming from the surrounding area of Wa, were recruited by the local chiefs 'in a shadowy borderline

between communal and forced labour' (Thomas 1973:103) to work as the first Northern labour migrants in the South. In early 1907, they and further groups (from other parts of the Northern Territories) were sent to Tarkwa, where they stayed between two months and more than one year. Additional recruitment campaigns were soon abandoned due to a massive outbreak of meningitis in the North within the same year. After the continuation of recruitment attempts at the end of the first decade of the 20th century, the number of Northern migrant workers, who predominantly came from the North-West, went up to more than 400. The increase was caused by the fact that the chiefs received money per labourer recruitment; in the first years, chiefs who were not willing to send their men to the South were threatened to pay surcharges in case of future denial. But observers from the colonial administration soon recognized the problems caused by the migrant labourer streams to the Southern mining areas; there was a high degree of 'desertion' - especially many labour migrants from the North-Eastern territories escaped before they even arrived in the mines. Working conditions in the mines were very poor and dangerous (what quickly became well-known in the North). Furthermore, the proportion of migrants who returned to their home areas was low; only just 20% of the 444 North-Western labourers, who had left for the mines in the Tarkwa area in 1909, returned home more than one year later. The obvious reason was the high mortality rates in the mine on the one hand. On the other hand, the otherwise more comfortable living conditions in the South made many mine workers to stay there (Lentz 2006:140-141).

Therefore, doubts of the colonial administration whether labour recruitments in the North was an adequate instrument of covering labour shortages in the Southern mines grew. The recruitments stopped before the outbreak of the First World War - despite the fact that mine managements were still allowed to look for additional labourers in the North. But this concession was also withdrawn when the outbreak of the First World War made it necessary to recruit soldiers in the colonies (Thomas 1973:79; Lentz 2006:68-69). Due to their comparably low economic value for the British empire, the Northern Territories had to contribute the largest amount of recruits among all parts of colonial Ghana in the First World War. More than 5,600 soldiers were provided from Ashanti, the Southern Gold Coast Colony, the Northern territories and British

Togoland.[16] Almost 3,900 of these soldiers came from the Northern territories (more than 70%) (Kasanga and Avis 1982:66).

Soon after the end of the First World War, labour shortages started again and the managers of the gold mines renewed their claims for labour recruitments in the North. The British colonial administration under then Governor Gordon Guggisberg correspondingly resumed recruitment campaigns in the first half of the 1920s in the Northern Territories. Guggisberg also had aspiring development plans for all the colonies under his administration. They were based on the building of railroad lines and the improvement of other infrastructural facilities to open up the timber-, cocoa- and diamond-producing areas in the Western and Central parts of Ashanti and the Gold Coast colony for export markets. Although Guggisberg developed plans to promote the cash-production in the Northern Territories - virtually based on Ferguson's suggestions -, the North was still of low economic value for the colonial power. Therefore, the area mainly remained a huge reservoir of labour force; virtually, the British established the basis for the enormous North-South development gap that is still very present in Ghana today. The question whether this was the wilful and deliberate intention of the colonial planners - as suggested by some (Neo-Marxist) authors (e.g. Shepherd 1979; Konings 1981) - or just the result of pure indifference (e.g. Staniland 1973) has always been the subject of a controversial research debate. However, similar patterns of (half-)forced recruitments of labour in combination with regional underdevelopment (especially via neglected educational development - see the following sub-chapter) or direct taxation were also standard means to guarantee a labour force inflow to economically more profitable regions in many other colonies throughout whole Sub-Saharan Africa (Kasanga and Avis 1988:62-65;69-70). Evidently, the economic perspectives for the Northern Territories were subject of a discourse between local officers in the North on the one side and Southern officials and member of the overall colonial government on the other side throughout the whole colonial time. While the former were confident in the economic development of the North, the latter saw the Gold Coast, Ashanti and the Northern Territories as a whole and the North predominantly as economically unimportant except for the supply of labour for the Southern economic sectors (Sutton

[16] British Togoland de facto started existing when after the outbreak of the First World War British and French troops occupied the by then German colony of Togo in 1914. The colony was then divided into a Eastern part under French rule and a Western part under the control of the British empire (Gründer 2000).

1989:642). In the 1930s, a local colonial officer in the North described the attitude of the central Gold Coast government towards the inhabitants of the Northern Territories with the words:

'They [the inhabitants of the Northerner Territories] were regarded as an amiable but backward people, useful as soldiers, policemen and labourers in the mines and cocoa farms ….fit only to be hewers of wood and drawers of water for their brother in the Colony and Ashanti' (Northern Territories Annual Report 1937-1938:3; cited in Howell 1997:39).

The pressure to intensify efforts of improving, commercialising and finally integrating the agricultural and forestry production of the North into the global market via agricultural extension work grew in the 1930 as the food crop production in the South was declining in favour of an increased cash-crop production (Der 1987:5). However, the British efforts in the Northern Territories were 'erratic and limited' (Sutton 1989: 654). Some half-heartedly launched projects of the (Northern) colonial administration in the 1910s and 1920s focused on the promotion of export-oriented cotton or shear-butter production, food-crop growing for the Southern parts of the Gold Coast Colony or an expansion of cattle rearing. The majority of these projects were stopped soon after being initiated. Apparently, the production of the agricultural commodities was too expensive, which was above all caused by insufficient transport means from the North to the South. Similar unsuccessful projects were re-launched for several times throughout the whole colonial period (Wardell 2005:175). A well-known example was the large-scale promotion of mixed farming methods with the aim to intensify the agricultural production in the late 1930s. As a result of this project, the low number of 715 farmers adopted mixed farming techniques about 20 years after the initiation of the programme. All these sporadic projects failed mostly for the same lack of sufficient transport opportunities and the inadequate and half-hearted support of the central administration. In addition, the continuous shortage of colonial staff in the area[17] as well as a high rate of staff turnover, both mainly due to the local illnesses, contributed to the failure of these projects (Staniland 1973: 46-49). But at least one small project actually provided

[17] In 1922, merely 21 political officers of the whole colonial administration were attached to the Northern Territories. Similar weak in numbers was the constabulary force for the Northern Territories, which was responsible for law-enforcement duties. In 1930, this squad had a total manpower of not more than 160 men being responsible for the whole Northern Territories (Staniland 1973:44-45).

the basis for the boom of small-scale irrigation in the study area beginning in the second half of the 1990s. In the 1930s[18], villages belonging to the community of Pungu - being close to Navrongo and obviously selected due to the short distance to this administrative centre as well as the good hydrological conditions - were the project site. Local farmers were taught by colonial agricultural agents how to grow vegetables during the dry season via irrigating their fields with water from small wells. The farmers adopted this practice and started to grow several kinds of vegetables for home consumption and for the local market. Given the low demand for irrigation-related agricultural products until the early 1990s, the appropriate knowledge did not spread to other villages. However, some villages maintained a dry season gardening culture by passing the knowledge from one the generation to the next (Laube et al. 2008:9).

Apart from failed attempts to rise agricultural production, the construction of a reliable road network became the major task for the colonial planners before the Second World War. On the one hand, vague plans of building a railroad connection between Kumasi and the North were quickly abolished due to the high costs; on the other hand, the capacity of the traditional transport means like canoes or small ships running on the different rivers of the Volta basin would not suffice to guarantee an economic reasonable production of cash-crops (Sutton 1989:643-644). But the road building highly depended on governmental capital grants. Until the 1940s, the net balance-sheet between road expenditure and its revenues remained negative; the same applied to the colonial revenue and expenditure sheet for the Northern Territories (Wardell 2005:175).[19] Therefore, the building of roads in the Northern Territories took very long and the transport situation did not improve significantly between the two World Wars (Sutton 1989:643). The same is valid for the promotion of health services and education in the North. In the Northern Territories, only a few hospitals existed throughout the whole colonial period with a very limited number of beds and without access to electricity (Kasanga and Avis 1988:68-71). Missionaries almost exclusively developed the health sector. Similarly, the British administration hardly supported the set up of an

[18] This time specification is solely based on oral histories of local farmers. The exact time may also have been in the late 1920s or the early 1940s.

[19] Throughout the second half of the 1920s and the early 1930s, the balance sheet between all governmental expenditures and revenues for the Northern Territories grew even more negative; whereas the balance sheet for the fiscal period of 1923/24 had a value of £ -78,884, in the fiscal period of 1930/31 it had a value of £ -115,558 (Staniland 1973:45).

educational system in the area. Until 1925, only five primary schools were built by the colonial administration in the whole Northern Territories - not one within the territory of today's Upper East Region.[20] The efforts of establishing schools were a domain of the missionaries in the region, such as the White Fathers, who founded a mission in Navrongo in 1906. But the work of the missions regarding school education barely found the support of the British. They feared that the missionaries - who in their majority were of Francophone-Canadian origin - could undermine the British authority in the region by making closer links to the French colonial empire with the long-term objective to extend the French colonial territory (Howell 1997:115-116). However, the main reasons for the British neglect was caused by concerns that the slowly developing patterns of labour migration after the First World War would be 'disturbed' by a growing number of educated people. The educational situation in the North did not improve significantly before Ghana became independent in 1957. Although the enrolment rate of public primary schools in colonial Northern Ghana increased from about 400 in 1929/1930 to more than 4,900 in 1949/1950, the total share of enlisted students in the Northern Territories in the pre-colonial Ghanaian primary school enrolment rate adds up to just 2% in the last mentioned school year. The share of the Northern Territories in the total public secondary school enrolment of pre-colonial Ghana even had a value of not more than 1% in 1949/1950 (Bening 1990:24).

The British efforts of recruiting unskilled workers from the Northern Territories for the Southern mines and for construction work in the early 1920s were quite successful as labour migration was increasingly considered as a coping strategy by the local population: severe famines in wide parts of the West-African Savannah occurred several times during the 1920s and the devastating influenza epidemic in 1918/1919 caused the death of thousands of people in the Northern Territories. These events made the peasant households to look for alternative income sources (Lentz 2006:141). Especially the famines forced many young men from the Northern Territories and also from neighbouring French colonies like Upper Volta (today: Burkina Faso), Togo or Ivory Coast to work in the mining sector and to a growing extent also on the cocoa plantations of the Gold Coast (Anarfi et al. 2003:10-11). Epidemics and famines coincided with the

[20] The enrolment rates within these schools were very low: in the school year 1925/1926, the total enrolment in governmental primary schools in the Northern territories was as low as 394 students in total (Benning 1990:14).

boom of the cocoa sector, which resulted from the infrastructural improvements in the central and Southern parts of the Ashanti and Gold Coast colony that were undertaken accordant to Guggisberg's Gold Coast development strategy (Austin 2007:3-5). The growing world demand for cocoa instigated this boom so that the export of cocoa from the Gold Coast rose from mere 2.3 tons in average during 1900-1904 to 224.4 tons in average between 1925-1929. The share of cocoa in the total export values increased from 11% to 81% in the aforementioned time (Gunnarsson 1978:39). The demand for labour in the Gold Coast cocoa sector therefore further went up. To ensure that this demand could be satisfied, the wages on the cocoa farms improved. This made the plantation work much more attractive than the work in the mines, where the salary levels were about three to five times lower than in the cocoa fields. At the same time, working conditions in the mines remained very miserable. The cocoa sector development attracted therefore more and more migrant workers from the Northern Territories and the surrounding French colonies. Careful estimations of the colonial administration indicate that the number of migrants - who were counted by entering the ferries of the Volta Basin in diverse cities - amounted to several ten thousands by the middle of the 1920s (Lentz 2006:141-145). Apart from attractive wages, a crucial reason for the boom of the labour migrant influx into the cocoa sector was the seasonal cultivation of cocoa. The Northern migrants were able to work on the cocoa plantations in the Southern forest zone - especially in the Ashanti Region, which was ever a centre of cocoa cultivation - during the Savannah dry season (October/November - April/May) and to return to their home territories to support their families with the rainy season farming (Anarfi et al. 2003:14). The absence of the migrants during the lean season notably released the pressure on scare food stocks (see chapter IV.1). Another important factor for the rise in the number of seasonal migrants going down South was certainly the introduction of a cattle tax in the late 1920s as well as the introduction of direct taxes in 1935 (Nabila 1987:149; Sutton 1989:667).

However, the developments in the 1920s and 1930s were virtually the beginning of the seasonal North-South migration as it still can be observed today. According to Fortes (1936:39-40), within a Tallensi community, which he did research on during the 1930s, about 15% of the adult men went to the South to work. Not less than 34% of the men staying at home the time they were interviewed had gone to the South to work during

earlier dry seasons. Obviously, the growth rate of seasonal migration must have been enormous. And the boom of seasonal migration further continued after the Second World War. According to Abdulai (1999:65), the number of men from the Northern Territories going to the South to work was estimated to be about 46,000 in 1945 and even 200,000 in 1954. Between April 1954 and March 1959, a (doubtable) number of 1,000,000 young men going to the South from the Northern part of the meanwhile independent Ghana was counted (Kassanga and Avis 1988:67). This further increase had several reasons: the world demand for cocoa grew again in the first one-and-a-half decades after the Second World War; accordingly, also the (pre-colonial) Ghanaian cocoa production went up again and required a lot of (migrant) labour force. But also other commercially oriented agricultural branches like the yam or maize sector as well as the timber industry started to be more and more attractive for migrant labour. The Northern migrants and the migrants from abroad further promoted the cocoa boom as shortages of available labour would have severely affected the production (Beals and Menezes 1970:112). The huge increase of labour migration to the South also followed very poor harvests in the Northern Territories in 1952 and 1953. In order to avoid hunger for themselves and their families, many young men went to the South (Howell 1997:44).

This massive growth of labour migration combined with the sporadic attempts by the colonial administration to further develop the Northern agriculture had the impact that the development progress of the North within the first decades of colonial rule was very small. Progress in the Northern Territories was predominantly dependent on economic or infrastructural developments in the South and therefore directly related to labour migration and higher wages for the migrants in the South over the decades. Salaries earned in the South helped to increase livestock production and led to the adoption of a monetary system in the North.[21] A first economic survey for the Northern Territories, which was conducted on behalf of the Colonial Office in the late 1940s, pointed out that the North still lagged behind the South with regard to all important development indicators (education, housing, human well-being, etc.). Furthermore, the survey stated that the North was far away from having a wide real economy: the estimated average

[21] In some places in the Northern Territories, cowries or brass roots remained the major currency until the 1940s (Sutton 1989:640).

annual per capita cash income in the North was for instance merely £ 2 at that time. The major recommendation of the survey's authors J.R. Raeburn regarding development perspectives of the Northern Territories was an increased food production to achieve a higher standard of living and a reduction of migration to the South. That would of course have increased the labour force in the Northern Territories. As a step forward, Raeburn suggested the same measures colonial officials and experts in the North had advocated long before: improvements in the transport system as well as an agricultural extension service-based improvement of the local agriculture via mixed farming and soil conservation measures. Raeburn also recommended new ways of addressing the Northern underdevelopment. He introduced intensified irrigation agriculture, the use of machinery or the utilisation of new arable land, which would have offered new settlement and cultivation opportunities (Sutton 1989:660). But his suggestions remained unheard, and the efforts to develop the North were still not part of the colonial agenda at the end of the British rule over Ghana.

After independence in 1957, the policy of the young state of Ghana under its first president Kwame Nkrumah aimed at a huge transformation of the Ghanaian economy in accordance with the development ideas and trends of that time. Nkrumah, who held Bachelor and Master Degrees from several British and US-American universities, was one of the cofounders of the pan-African movement and one of the leading exponents of African socialism. His development agenda focused on a transformation of the old colonial economic structures. Accordingly, an important pillar of his agenda was the overcoming of Ghana's high dependence on agricultural products, timber and minerals by furthering industrialization approaches, which were also supposed to be initiated by the (rather unsuccessful) attempt of attracting foreign capital. Consequently, the Ghanaian state massively intervened in the agricultural in- and output markets by establishing farmer cooperation and state-owned agricultural enterprises. Another policy measure in that context was a direct subsidization of agricultural inputs in order to reduce food imports and prices and to guarantee an adequate supply with agricultural raw materials for the local industries (Laube 2007:63-69).

Due to this development agenda, the Northern part of Ghana benefited from public resources in a way it never had experienced during the whole colonial time. Especially those areas considerably benefited which were well-disposed towards Nkrumah's

'Conventional People's Party' (CPP). The aim to overcome the Northern underdevelopment was also addressed by investing in the Northern educational sector. Correspondingly, between 1958 and 1966 the enrolment in primary and secondary schools improved to a large extent: in 1957 only 20,000 students were attending primary schools but the number went up to more than 90,000 eight years later. For the secondary schools, the enrolment rate even increased by more than 650% from less than 240 students to almost 1,600 in the same time period (Benning 1990:48). The adoption of major parts of Ferguson's, Guggisberg's and Raeburn's ideas of making the North the national bread-basket of Ghana by making it a major supplier of cash-crops and agricultural raw materials for South Ghana became however more important in Nkrumah's development perspective. Consequently, a reduction of internal labour migration was a clear objective as the Southern manufacturing industries were expected not to need Northern labour migrants but rather to rely on skilled workers of the South. The planned increased cash crop production in North Ghana on the other hand would have significantly created employment opportunities for potential migrants (Konings 1986:140-141). Besides the establishment of a few state- and cooperative farms, the ambitious development policy was reflected in the establishment of agro-industrial facilities in the North, such as a rice mill in Bolgatanga or the tomato canning factory in Pwalugu. In addition, the construction of small dams in order to give farmers the possibility to cultivate vegetables in the dry season throughout the whole North was planned and initiated. Also plans to create medium-scale dams were created in this time (Laube 2007:63-65).

But the performance of state farms throughout whole Ghana remained very poor. In the mid 1960s, about 90% of the total agricultural development budget of Ghana went into (in peak times) more than 130 farms, where approximately 21,000 labourers - to an increasing degree with the help of agricultural machinery - worked (Bates 2005:46). The share of the state farms in the total agricultural output of Ghana was less than 0.5% (Miracle and Seidman 1968:35). In contrast, the efficiency of subsistence farmers was much higher than that of the state farms whereas the ecological impacts of the mechanized and mono-culture-oriented state-farm agriculture were much more severe than the impacts of the traditional peasant agriculture (Konings 1986:168-170). The small amounts of money allocated to the cooperative farms in the North with the

objective to improve the peasants' standard of living or at least to secure their food supply were often peculated by local officials. Those used farm equipment for their own private farms or distributed foodstuffs, which was produced by the cooperatives, to their relatives or kept on their own (Shepherd 1979:46-50). The plans of reducing the development gap between North and South Ghana in the era of Nkrumah's presidency, who was overthrown by a military coup in 1966, clearly failed. Until the 1960s, the high poverty rates and the poor performance of the agricultural production in the North made labour migration even more important - instead of decreasing it as intended by Nkrumah's development agenda. An additional factor was certainly that travelling to the South now was easier, faster and more secure than in the past. The reasons for that were essential improvements of the road network, which were undertaken in accordance to Nkrumah's development policy. A trip via bus or lorry to the South now took not more than one or two days (and was comparably cheap). In the 1930s, seasonal migrants usually walked for two or even more weeks to get to their destination areas (Anarfi et al. 2003:17-18).

The military coup against Nkrumah was mainly caused by the ever increasing degree of oppression his regime was characterized by. Especially within the last years of his presidency, the degree of oppression as well as the extent of corruption of Nkrumah's leading CPP members rose. The coup was the beginning of long phase of political and economic turbulences in Ghana, which comprises not less than six military coups. The phases of military dictatorships (1966-1969; 1972-1979) alternated with short periods of democratically elected presidencies between 1969 and 1972 as well as between 1979 and 1981. Despite different ideological orientations, all the different Ghanaian governments after independence launched similar policies predominantly aiming at an ideal combination of a highly state-controlled economy with opportunities of private capital accumulation. Especially Prime Minister Kofi Busia (1969-1972) and President Ignatius Acheampong (1972-1978) wanted to promote the commercial agricultural production also in the North. Busia launched for instance programmes to promote commercial rice farming via e.g. a further increase of subsidies for agricultural inputs and services and advantageous bank loans. For that purpose, the state farms were partly privatised. These policy measures had some success; by way of example the acreage

under rice cultivation in Northern Ghana rose by 45% between 1970 and 1972 (Goodwin 1975:45).

However, these efforts could not really stop the food crisis Ghana underwent during the 1970s (see the following sub-chapter). Above all, the urban demand was not met and Ghana more and more had to rely on food imports. Acheampong also supported commercial agriculture but rather focused his agricultural policies on the aspect of food self sufficiency ('Operation Feed Yourself') amongst others with the help of increased machinery imports. Several projects in Northern Ghana were supported, such as the upland rice farming in selected parts of the Builsa District, the medium-scale irrigation scheme in Vea as well as the construction process of the Tono dam. On account of the disadvantageous position Ghana had in the 1970s in terms of external trade -mainly due to the declining world cocoa price and increasing oil prices - all policies aiming at a promotion of an export-oriented commercial agriculture in Northern Ghana were unsuccessful (Konings 1981:11).

As Konings (1986:170-177) states, those attempts did not overcome pre-capitalist peasant modes of production in Northern Ghana but helped to form a new class of capitalist farmers mainly made up of farmers from Southern or Central Ghana. The latter were attracted by government incentives, such as subsidized fertilizers or advantageous bank loans and also by a rather uncomplicated access to local uncultivated lands and the locally available, casual labour force. This small agricultural elite used means of political patronage to guarantee their personal benefits. In contrast, only few agricultural smallholders in Northern Ghana could really benefit from the commercialisation attempts being made in the 1960s and 1970s (Laube 2007:69-70). In other words: those policies 'once again by-passed the bulk of the North-Ghanaian peasantry' (Konings 1986:171)

Consequently, the number of seasonal migrants did not decrease and at the same time also permanent migration from Northern migrants to Southern Ghana became more widespread. That permanent migration appeared more often in the time after the Second World War and the early post-independence Ghana has several interdependent reasons. First of all, a growing number of migrants developed a long-term goal of improving their standard of living lastingly on a more permanent base in the South. Therefore, they

had to stay for a couple of years to guarantee some savings. They were able to do so as the population growth rate in the North was still very high. Accordingly, the pressure on farming areas also grew and the domestic labour demand in their home farm households was already supplied without the permanent migrants' labour force (Hart 1971:21-26). These trends were accompanied and even increased by a decline of the Ghanaian cocoa industry beginning in the mid of the 1960s and reaching its peak in 1983 when due to bushfires and droughts the whole cocoa sector was close to a total collapse. With this decline, also a shift towards urban (formal and informal) labour markets as centres of attraction for seasonal migrants took place followed by a further shift to other agricultural sectors besides cocoa farming (Anarfi et al. 2003:14). The general trend towards more rural-urban migration was increased by the urban-focused policies of the Ghanaian governments throughout the 1960s and 1970s. These policies turned the terms of trade in favour of the urban production sectors against agriculture and thus led to an increase of rural-urban differentials of income. Accordant policies included protection measures for the industrial sector, over-valued exchange rates and still considerable interventions in the agricultural input and output markets, which widely led to low agricultural production rates and farm incomes (Abdulai 1999:62-64). Particularly seasonal migration has been not only a temporary coping strategy as response to droughts, poor harvests, epidemics or household food shortages; it also turned out to be an adaptation strategy as a response to high population pressure on natural resources (Mensah-Bonsu 2003). First of all, the rising population growth rates in Northern Ghana during the 1970s and 1980s (see chapter IV.1) have increased the pressure on existing farm lands. This also entailed decreasing soil fertility levels as well as the massive logging of North-Ghanaian forest areas. Braimoh (2004) sees a direct link between these massive patterns of environmental degradation and a further increase in North-South migration in the mentioned period; other authors (e.g. van der Geest 2004) conclude that political and economic factors have had a stronger impact on the degree of inner labour migration in Ghana than environmental factors.

At the beginning of Jerry Rawling's presidency in 1981 following a military coup[22], the economic situation in Ghana was devastating and close to a total collapse. Due to a very

[22] Rawlings undertook already two attempted coups before, both in 1979. After a first unsuccessful attempt in May 1979, he finally could overthrow the military government under General Fred Akuffo one

adverse development of the gold and cocoa prices the failed approaches to combine a state-controlled economy with a high influx of foreign capital, the tenacious commercialisation policies in the agricultural sector as well as the infamous *kalabule*-system[23], which was accompanied by a high degree of corruption and political patronage, the economic resources of Ghana were unscrupulously overexploited. As consequence of the economic development, food prices in 1981 went up by more than 100% and the Ghanaian state underwent a heavy fiscal crisis. The situation even worsened when in early 1983 Nigeria expelled more than one million Ghanaian migrants, who in their majority have escaped due to the crisis at home, back to their home country by force. Furthermore, several severe droughts were heavily affecting particularly the Northern part of Ghana but also the complete food production sector in overall Ghana. In addition, also many cash-crop plantations were destroyed by uncontrolled bush fires at that time. The resulting serious food crisis forced many people in Northern Ghana to eat roots and leaves. Rawlings, who initially was quite successful in coping with the food situation in Ghana by using military and police forces as well the so called 'revolutionary organs' to violently control national markets, had to find different measures to overcome this situation. Despite Rawlings' socialistic rhetoric and initial intentions, he was forced to ask the World Bank for assistance in spring 1983. The granted aids financed by the IMF, the World Bank as well as a couple of bilateral donors were attached to the implementation of a structural adjustment programme, which was announced as Economic Recovery Programme (ERP). The economic measures linked with the structural adjustment agreement introduced some serious discomfort for the Ghanaian population, such as wage freeze, higher prices due to a devaluation of the Cedi and rising unemployment rates in consequence of the close down or privatisation of many state-owned companies (Nugent 1995:132).

One of the policy measures under the umbrella of structural adjustment was the initiation of a decentralisation process in order to foster regional economic

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month later. A short intermezzo with Rawlings as president followed a two-year presidency with Hilla Limann as democratically elected president. Limann was in 1981 again overthrown by Rawlings, who then remained the President of Ghana for the next 20 years.

[23] *Kalabule* basically means a certain system of shadow-economy; the high influence Ghanaian state agencies had in all sectors of the national economy accompanied by strictly fixed exchange rates for the Cedi plus fixed import and export prices throughout the post-independence era have created a lot of opportunities for black market activities including illegal exchanges or the selling of contraband articles (Laube 2007:66).

development. Nevertheless, according to Shepherd et al. (2005:3), decentralisation never could compensate the neglect lasting for decades of the North's economic development issues. However, in the 1980s a broad NGO landscape emerged in Northern Ghana, which in its diversity is quite unique in Ghana. Due to the low levels of activity of the Ghanaian state in terms of development initiatives, the NGOs stepped into the breach. The activities of these non-state actors could induce some significant improvements, especially in the North Ghanaian health and education sector (Blench 2006b:6-7, Shepherd et al. 2005:3). The downfall of subsidies for agricultural inputs as integral part of the structural adjustment measures as well as the collapse of rural credit schemes and the downsizing of agricultural extension services in the study region had the consequence that an improvement of the Northern rainy season farming conditions - one of the declared goals of the Economic Recovery Programme - largely failed (Laube 2007:70-76).

As an emerging general trend in the late 1970s and 1980s, the migration rates from Northern Ghana declined on account of the changes induced by the macro-economic consequences of the SAP and the downfall of the cocoa industry before (Anarfi et. al. 2003:14). Since the 1990s, the rehabilitation of many small irrigation schemes, which over the years had become unsuitable for irrigation farming mainly due to poor construction quality, gave a slight push to the commercial and the commercially oriented peasant agriculture in the Northern part of Ghana. Furthermore, the expansion and rehabilitation of electrification and road infrastructure (e.g. the rehabilitation of the Kumasi-Paga road), which were not at least initiated to establish a Northern clientele for Rawlings and the PDNC, enabled further agricultural as well as other economic activities, such as heavily increased trading flows to and from the North (Laube et al. 2008:10).

However, whether those development initiatives in Northern Ghana have had an impact on decreased migration flows is unanswered. For the 1990s, even a slight increase of seasonal migration from North Ghana to the Central and Southern parts of the country can be assumed (van der Geest 2004:8-11). Latest research on seasonal migration comes to the result that in particular the increased use of machinery and herbicides in the Southern commercial agriculture - for decades the major attracting sector for many migrants from Northern Ghana - has superseded many migrant labour jobs (Amegashitsi

2008:90-91). According to Litchfield and Waddington (2003:3) the amount of the Ghanaian adult population which ever has migrated in their lifetime dropped slightly from 58% in the early 1990s to 53% in the late 1990s. Based on computations from census data of 2000 Tsegai (2005:75) comes even to the result that the amount of in-migration to the Upper East Region in recent times has slightly exceeded the amount of out-migration, which is also valid for other parts of Ghana's North.

Migration in permanent or seasonal form is very common in many districts of Northern Ghana and definitely takes place in the study area; the high amount of out-migration is for instance reflected by population growth rate for the Kassena-Nankana District with a value of -0.1% for the time 1984 - 2000 (see table IV.2). Hart (1971) as well as Hahn (2004) come to the result that the increased seasonal migration flows as well as the risen number of permanent migrants to Southern Ghana - particularly in the time after the Second World War - have changed the ethnic identity of North-Ghanaian ethnic groups and made them trans-local societies. For that reason, migration decisions as well as migration processes have become very spontaneous and day-to-day. Nowadays it is usual that in rainy season harvests and throughout the whole dry season additionally to the young men, more and more women and children leave their homes to stay at their relatives' places in South Ghana (see Photo IV.2). This has various reasons like better school education or work issues (Hashim 2005).

Photo IV.2: A young female migrant in Techiman with her three years old son, who accompanied her

Source: John Amegashitsi

This development was significantly pushed by the specific migration trends of the last decades and is related to risk mitigation strategies connected with migration. Due to some reasons already mentioned, in the last two-and-a-half decades employment in some agricultural sectors (especially in the urban sectors) was not as easy to access as for instance employment on cocoa farms, predominantly in times of urban labour surplus. This actually led to a further increase in the trend towards more permanent labour migration in urban sectors; because once a migrant could obtain a job he did not want to loose it again that easily. Despite the partly severe difficulties in finding employment in the cities, the urban labour markets became very attractive as especially

in the public sector - and to a lesser degree in the private sector - the payments of pensions or gratuities had become quite common in Ghana after its independence (Hart 1971:21-26). To overcome such difficulties as tedious processes of job finding, the Northern migrants developed their own coping capacities by relying on kinship networks (see chapter IV.4). The roots for these network ties have their origin in the early times of internal labour migration in pre-colonial Ghana. The first permanent migrants from the Northern Territories settled in the mining areas already in the late 1920s. By and by, the permanent settlers began to take their wives with them and as a result their communities got bigger. These early permanent migrants were usually selected by colonial officials as so called 'tribal heads' or 'tribal chiefs'. They were the first contact points of seasonal labour migrants and their major tasks comprised the instruction of the newcomers from the North and the social control over the migrants (Lentz 2006:146-148). Over the years and decades those networks gained an increasing importance because they could guarantee the mediation of jobs and accommodation for newcomers, being especially important as jobs got rarer and rarer. Moreover, the kinship networks also took and take care of important social obligations like the burials of migrants who die during their migration stays. In the course of time, these tribal networks have led to a high concentration of migrant workers from one section or one village in certain work sectors. Hart (1971:27) for instance reports that 20 out of 22 residents in Accra belonging to one Northern section work as cooks or stewards.

Photo IV.3: Group of Northern seasonal migrants, who just have arrived at a relatives' place in Techiman municipality

Source: John Amegashitsi

Part of the 'claiming' of lineage networks was also the traditional form of travelling in groups. To gain from the experiences of men who already went to the South to work before or who knew one of the permanent migrants with the same sub-sectional or sectional background as initial contact point, the mode of travelling in a small group slowly emerged. Within the first decades of labour migration in pre-colonial Ghana it became normal that even bigger groups from one (sub-sectional or sectional) neighbourhood or village were more and more popular. Especially in times when the transport system was largely insufficient and the way down South took rather weeks by foot than days by the lorry, travelling in groups was an adequate way to reduce risks and dangers like becoming victims of crime or wild animals' attacks. Usually, those groups started their journey together and stayed together for the whole time of their migration to go to a contact person of the same kinship background for the agency of accommodation and jobs; in former times it was rather common that groups worked together for the same employer (Hart 1971:25-27).

IV.3 The cultural meaning of labour migration in Northern Ghana

The migrants' individual motivations for going to the South were quite manifold: especially the older ones earned money to support their families at home, some of the younger migrants escaped from social control in order to experience 'modern' city life in the urban areas of the South and others went to get their financial means for the dowry or the setting up of an own building. Family responsibilities - in particular the becoming of the family or household head caused by the father's death or sickness - remained the most important reason for the majority of migrants (seasonal as well as permanent ones) to give up seasonal migration or to return home. Over the years, the majoritiy of the economic studies which had the aim to analyze the economic effects (seasonal) migration in Ghana has for the home households (e.g. Arthur 1991; Mensah-Bonsu 2003; Tsegai 2005) focused on financial remittances. Many of these studies come to the result that migration has rather negative impacts on the home households and communities due the loss of labour force in the home communities and other reasons.

Therefore Hahn (2004:382) justifiably poses in a rhetoric way the question why labour migration in the West-African context has been that important despite the negative impacts mentioned. One answer to that question can presumably be found in the perception of many economic studies - especially the older ones - on migration phenomena. They however have not taken into consideration the circumstance that an important benefit for many migrant households is first of all the absence of an eater; this especially applies to the analysis of subsistence farming. Several farmers interviewed during the field research related to this thesis said that the saving of food due to the absence of a migrant was more important than the remittance of money or food particularly in the lean season, where food stocks in peasant households could run dramatically low. One of the interviewed farmers, who also farms a small tomato plot during the dry season, went to the South for two months at the end of the dry season in 2007 after he had massive problems with selling his tomatoes. He expressed this economic function with the following words:

‘I did not earn much money in the South. Most of it, I had to spend for the transport back home. That is no that severe. But if I had stayed at home in March and April, I would have been forced to sell my fowls or other animals for buying some food and I was not really willing to do that. So, I knew that when I go that at least there will be enough food in the house for my wife and my children’ (Interview with Aken A. (45), Kandiga, 23.04.2007)

Thus, (seasonal) migration is possibly rather a food saving strategy than an income generating strategy for the North-Ghanaian peasant households. This circumstance can also be observed in other parts of semi-arid West-Africa; for instance Rain (1999) reports for Niger that the absence of potential eaters (as what the seasonal migrants are largely perceived as) during the dry season is highly appreciated in the home communities. Similarly, Konseiga (2005:226) found that seasonal migration from Burkina Faso to Cote d’Ivoire (for the time period 2000 - 2002) is not least a household strategy to smooth food consumption.

The long-lasting and wide neglect to integrate non-financial remittances into their analyses largely biased older economic studies. According to several interviews being conducted in ‘home households’, the appreciation of food remittances by the migrants or the bringing of such items as bicycles and construction materials is partly higher compared to financial remittances. This can be explained with the fact that those items are to some extent much cheaper in Southern Ghana than they are in the North.

Besides economic considerations also other incentives attracted young men from the North to leave their homes in the dry season to work in South Ghana - right from the very beginning of this migration pattern in the early 20th century. Many observers in that time report that goods like soap, industrially produced clothes or towels, which so far were unknown in the North but were increasingly brought by the migrants to their homes on their return, caused an enormous fascination. Especially the young men were impressed and also encouraged to leave and buy those products and to experience impressions of ‘modern’ (city) life in the South. This led to a situation that in many Northern communities the seasonal migration of some of the young men involved the chain-migration of more workers, who also wanted to go and experience modern city life in the South as well. But the stays in the South obviously induced changes in the migrants’ behaviour: already at the very early days of labour migration, many colonial

officers were concerned because some of the labourers from the North significantly changed their life-style and attitudes during their stays in the mines (Lentz 2006:141). In particular the officers could observe that the migrants

'… have conducted drinking habits and other vices… [they] … have been infected with venereal and other diseases … and [they] … have become insubordinate to their tribal chiefs' (CCNT/Secretary of Mines and Transport Officer 1910, cited in Lentz 2006: 141).

Interestingly, concerns about the migrants changing their lifestyle, their cultural or political attitudes and consequently the loss of traditional values have remained a recurrent theme in the local perception of migration in Northern Ghana until today. Despite some doubters, the majority of the British colonial officers unconsciously promoted this development. Many of these had a sense of mission that accounted the traditional life in the Northern Ghana as savagely and backward, which also applied to many Southern tribes before and after Ghana's independence. For that reason, the colonial administration regarded the North-South migration also as an education measure for the Northern population. At that time, especially the rather sparse clothing as well as the wearing of bows and arrows were in the eyes of the colonial administration an unmistakable sign of savagery. They saw the need for the Northerners to familiarise more with the 'civilized world'. The self-perception of being underdeveloped and backward resulting in the need to contact the modern world became increasingly part of a common conscious in the Northern Territories as a result of this 'culture contact as a dynamic process' (Fortes 1936:26; see also the previous sub-chapter). Consistently, in the local Northern opinion the young men's stay in the South emerged to something like a rite of passage from childhood to adulthood (Lentz 2006:146).

Due to these cultural implications, the attitude towards migration of the ones who were staying behind in the home communities has changed over the years. In some of the interviews being conducted in the study region, some old men reported that at that time when they or their fathers for the first time decided to go to the South to work in the dry season (in some cases already in the 1920s), their fathers actually did not want them to leave. They were afraid that they would not return or that their sons would grow apart from their families. The curiosity of some men however was so strong that they even

stole one of their fathers' animals to get the money for the travel and then secretly stole away during the night. Although in the first decades of North-South labour migration in pre-colonial Ghana the general attitude in the Northern communities was rather sceptical concerning this development, things changed essentially thereafter. Fortes (1936) comes to the result that in particular labour migration in the Northern Territories among other contact points to the 'modern world' (such as the activities of the Christian missionaries or the colonial officials in the 1930s) has already changed traditional social values. For instance, Fortes analyzed that there was a tendency towards more individualization even among people who never had been to the South.

Franke (1982), who did his research on a Tallensi peasant community in the late 1970s and early 1980s, makes the conclusion that migration has gained a high cultural appreciation also among the non-migrants, not least due to the fact that in those days many of the old men remaining in the villages had gained migration experience in the past on their own although the old men's general position towards migration was ambiguous as they were described of being afraid that no one would take care of the ones staying behind. However, the cultural appreciation is outlined to be above all linked to experiences migrants gain in the South like the handling of money or general knowledge about the outside world that for instance could be used to prevent the community of being a victim of fraud or cheating. Similar for example to Caldwell's analysis (1969), the North-Ghanaian peasants in Franke's study regarded themselves in comparison to South Ghana and especially to the Southern urban areas as backward and disadvantaged. Consequently, they wanted to get more modern and progressive knowledge. They expressed their approval of seasonal migration with the word *ninlagker*, which can be translated with 'to open one's eyes'. According to Franke, this phrase can be understood as a synonym for 'civilization'. Obviously, the old colonially implanted self-perception of the Northerners of just being a savage reservoir of unskilled labour accompanied by decades of economic marginalization has influenced the Northerners' mentality. On the other hand, there was the opinion among the non-migrants (especially the old ones) that migration leads to lacking labour force in the home communities.

In a more recent publication, Hahn (2004) describes the cultural meaning of seasonal migration in a Kassena community in Burkina Faso, close to the Ghanaian border. This

community also has a long history of (seasonal) migration to Southern Ghana comparable to the one in the study region. Hahn comes to the result that a very important motive for going to the South for the young men is the acquisition of certain goods as icons of Western lifestyle, for instance special clothing, CDs or posters. Young people demonstratively displayed these goods as an attempt to increase their social status and as a sign of 'having been there'. It also indicates that there has been a shift from cultural appreciation to a more materialistic approval. Aspects like the transfer of knowledge obviously do not play such an important role any longer in times of Northern Ghana's improved access to modern mass media within the last years (see chapter V.2).

IV.4 Between continuity and change: social organisation and cooperation in Northern Ghana in their historical context

As it will be shown in the further description, certain forms of social cooperation are not only important for mitigating risks associated with migration, they also have played and still play a decisive role for the diffusion of riverine small-scale irrigation farming in the dry season. In the following, the institutional set up of the local social organisation including their historical origins will be described. Although certain historical developments left their traces in the current institutional setting of the study area, the patterns of social organization as such have remained quite unchanged over the decades and centuries.

The Upper East Region is not only characterized by a high population density but also by a high ethno-lingual diversity. The major ethnic groups of the Upper East Region are the Bimoba, Mamprusi, Kusasi, Kassena, Builsa, Nabdam, Nankana and Tallensi.[24] They all have their own languages that belong to the Gur language family. In total, more than 20 languages are spoken in the North-Eastern Ghana but no indigenous lingua franca exists throughout the whole region. However, English, Twi and especially Hausa

[24] Especially the three last mentioned ethnic groups are oftentimes summarized as 'Frafras'. This expression was most-likely introduced by the first colonial officials in the Northern Territories and originates from the common greeting 'ni-I fara-fara-fara' (Fortes 1945:16). There is no clear common definition of which ethnic group exactly belongs to the collective group of the Frafras and which does not.

are widely spoken and understood. The population of the Atankwidi and the Anayare catchment is made up in its large majority of a Nankana and Kassena descent. Only the Community of Pungu is clearly belonging to the Kassena area while Doba is rather mixed. The rest of the communities are part of the Nankana area.

The ethnic diversity is also accompanied by an alleged high religious variety: traditional believers are the dominating religious group in the Upper East Region with 46.4%. They are followed by the Christians with 28.3%; about three quarter of the Christians are Catholic and the remaining one quarter is composed of diverse protestant or charismatic churches. The remaining 22.5% are Muslims being the dominant religious group in the two other Northern regions (GSS 2002). As the Muslim population of the Upper East Region (except for the Bawku area) is mainly living in the urban areas and predominantly engaged in trading activities, the peasant population in the region is usually non-Muslim, which also has certain historical reasons (see below). In fact, a clear classification between the religious groups in the study region is hardly possible because many households - especially among the agricultural, rural population - are practicing a hybrid practice of religion; this means that they are worshiping the Christian god as well as the traditional gods in parallel ways. Correspondingly, it is absolutely normal among many peasant families to attend for instance the catholic Sunday church service and to worship the ancestors on Monday to guarantee a good harvest. This practice can also be widely observed along the whole Anayare and Atankwidi catchment area.

Eguavoen (2008:77-81) undertook a very detailed ethnographic description of the community of Sirigu, one of the villages that is also part of the survey area of this study. Generally, the society in the region is mainly patrilineally organized, which is manifested in inheritance rules, marriage patterns and settlement structures. However, also matrilineal kinship connections are an important determinant for networks between whole villages characterised by dispersed settlement structures. Those networks may be of importance in times of food shortages or other severe events affecting people's livelihoods (see also Cassiman 2000). The primary platform for reciprocal solidarity generally remains the patrilineal kinship cluster. A whole village can in patrilineal terms be divided in different sections called y*i-zuto* in Nankam. This term can be translated with head houses (Eguavoen 2008:79). Each section is usually divided into several

subdivisions, so called sub-sections. The elders or most senior members of the clans representing certain conglomerations of patrilineal related compounds, or the sub-sections' elders come together to chose a representative, who is called section head. The section head is responsible for settling disputes, performing certain rituals, taking decisions and representing the section at meetings. The head is a 'primus inter pares' as he always has to meet the approval of the section's elders before he can enforce his decisions (Laube 2007:119-121).

Traditionally, marriages between members of the same section were not allowed. But Laube (2007:126-132) reports that within the last years more and more young men have started to date and marry young women from the same section, which indicates that inner-sectional marriages are not that much of a taboo anymore. Yet, marriages may create strong affinal ties between families and between certain sections possibly lasting for several decades. The reason is that marriage is in the local context a prolonged process covering several stages. First of all, marriage is patrilocally organized; therefore the marriage process virtually starts with the wife's move to the husbands' compound a part of the husband's parents' compound and economically still closely related to the parental compound. The wife and the common children will belong to the husband's patrilineage only after the full bride price has been paid. The bride price of between one up to several cows (depending on the community) usually has to be paid on request by the wife's father even years after a couple has married. But also apart from the bride price, reciprocal bonds in terms of labour support or material assistance may develop between the affinal households (Laube 2007:130-131).

However, the number of sub-sections per section usually differs. In Sirigu, which has a total number of 29 sub-sections, it comprises for instance between four and nine sub-sections for an overall number of five sections. At the section level, geographical and social unit largely form a whole while this unity becomes ambiguous at the sub-sections' level. Caused by a high degree of (mainly marriage-related) inner village migration and less clear defined geographical borders within the communities, sub-sections do not necessarily form a unique part of the village. In Northern Ghana, borders between villages oftentimes exist in diverse and coinciding contexts. Also the particular water source of a household can for instance make it to a certain extent part of

another community if the water source belongs to another geographical part of a community or even another community (Eguavoen 2008:79).

The core of every sub-section is the household. It is still quite common that several households usually patrilineally related to each other and belonging to the same (sub-) section, live together in one farm compound. These compounds are characterized by an exceptional and very functional shape that supposedly even inspired the influential Swiss architect Le Corbusier. They are made up of several living rooms, a big granary and several storage facilities surrounded by a wall. This wall usually leaves some space for barns for the smaller animals like guinea fowls and chicken. In front of the compounds, oftentimes small shrines in form of one or several stones, which are used for traditional animal sacrifices, can be found (see Photo IV.4). Shrines can also be made of mud; those represent gods or ancestors.

Photo IV.4: Farm compound in the Atankwidi catchment

Source: own photo

Polygamous households, which according to the 2007 household survey make up 21% of the sampled households, may - depending on the number of wives - occupy one compound completely. According to the 2007 household survey, the average compound hosts 3.1 households with an average size of 6.7 members. In the prevalent local definition, a household is a group of relatives, who all eat from one pot - although this mixes up sometimes. In many polygamous households for instance, every wife cooks for herself and her offspring. However, the typical farm household in the study region is made up of a husband, his wife and their children, mostly with the husband as head of the household. Women as household heads appear only when the husband has died or is staying outside of the household for a longer time. In compounds with several households, there is usually a compound head, who is also called *yidaana*. The head of the compound is normally the most senior man of this compound in a generational sense (Eguavoen 2008:78-79). The compound head's task is to use the household's assets in the overall compound's interest; this goal however cannot always be met. Correspondingly, conflicts (e.g. over livestock) are not rare (Laube 2007:131-132).

The origin of today's population in the study area is quite diverse: it is for instance assumed that the Kassena originally came from the Northern areas close to the Sahel whereas the Nankana and the Builsa are said to have rather heterogonous origins (Laube 2007:50). There are indications that the first permanent settlements were established about less than 300 years ago (Howell 1997:25).[25] However, exact statements in this context are hard to be made due to the circumstance that the settlement or ethnogenesis history of the diverse ethnic groups of the region entirely relies on oral histories. Anyway, a central motive of the region's history was that new settlers had to deal and live together with long-time residents. The whole area in the pre-colonial time was exposed to several severe dangers. In the late 18th and early 19th century, regular attacks by slave raiders from the powerful neighbouring kingdoms of the Dagombas, Gonjas and Moshi became more often. Especially the Gonja and Moshi kingdoms controlled different important points of the profitable trade routes to guarantee the trade flows of spices, livestock, clothes and - the most remunerative income source- slaves. These trade routes reached from the Northern Sahelian and Savannah areas to the Southern

[25] Zwernemann (1969:4) for instance assumes that most of the Kassena settlements were founded between 1745 and 1815.

forest belt or vice versa. The Moshi as well as the other kingdoms never attempted to annex the 'Grushi'[26] area because that would have hindered them of raiding a 'lucrative territory' as base for their slave trading activities. Furthermore, the area remained a buffer zone between the kingdoms, in which slave raiding never violated the sovereignty of any of the other kingdoms (Howell 1997:28-32). Another danger for the local population was the permanent thread of violent conflicts among different villages and dangerous wild animals, which at that time still lived in large quantities in the bush. Due to those circumstances, which made cooperation among a biggest possible number of people or even smaller communities very beneficial and desirable, the rapid integration of newcomers to the area was common by long-time residents. Consequently, the integration processes were said to be of a rather uncomplicated nature (Laube 2007:50). The result was that ethnic bonds were rather weak and a central political power within the different communities was largely missing. Correspondingly, the social organisation in that time was characterised by predominantly segmentary and paternal-kinship based groups (Schott 1977:155).

But in the shape of so called earthpriests (*tindana* in Nankam[27] and *tigatu* in Kasem), at least spiritual leaders in those rather acephalous environments were established and still play an essential role until today (Laube 2007:50-51). They were and still are mainly men from the lineage who were first to settled in a certain area or at least they are said to be of that origin despite the fact that many are also appointed as *tindanas* for a special locality by a superior *tindana*. Due to their (alleged) ancestral rootage, they are considered to have a special relationship to and as a result certain responsibilities for the land and also for all creatures living there (Lentz 2006:18-20).

The main spiritual task of a *tindana* is the approaching of the spirits by sacrificing to them at certain shrines. The spirits are believed to be resided in sacred rocks, streams or grooves; the sprits are said to be responsible for all creatures (including humans) living on the land. The approaching of the land spirits is based on the mediation of the

[26] Lentz (1998:103) assumes that the term Grushi, which became common in the described time period among the neighboring regions as synonym for the population in the study area, goes back to Dagbane or Songhai language and implies several meanings, such as 'bush men', 'foolish ones' or 'wearer of leaves'. All meanings have connotations that indicate that the people living in the area were largely perceived as savage, warlike and barbarian.

[27] Since the Nankam word t*indana* was the farthermost used term in the study region of the Anayare and Atankwidi catchment, I will mainly refer to this term in the following.

tindana's ancestors due to their believed close relationship to the spirits. The major purpose of the approaching is the pacifying of the spirits to guarantee their goodwill. That is especially important in case that a certain condition, which the *tindana* usually speaks out after having given a plot to somebody, is breached; such a condition may be for instance not to kill an animal on that certain piece of land. But the earthpriest is not only responsible for the land in spiritual terms; in fact, he is also a superior landowner in his area, so that he in fact has the allodial property rights of the land. He is therefore virtually in charge of the allocation of land to anybody who wants to farm or settle in the *tindana's* territory. As long as they are still free plots available, the *tindana* allocates the plots for a symbolic token, which may be a fowl, kola nuts, drinks, etc. The land is neither sold nor it is rented; the land will remain the property of those who have acquired the plot in case it is continually farmed and inhabited. The plot remains in the control of the patrilineal kinship group. Especially after good harvests, it is still usual to give traditional tokens to the *tindana* (Laube 2007:158-162). Rattray (1932:xi;45) even describes the office of the earthpriest as a mixture between a priest and a king because besides his tasks as a custodian of the land, i.e. the direct translation of *tindana*, they also had some political power. Although this interpretation seems to be a little bit overdone, there is evidence that in pre-colonial times particularly those earthpriests who were able to organize defensive measures against violent intruders and at the same time were quite wealthy, could develop some influence in secular issues. They could for instance function as judges when conflicts between different kinship groups appeared (Dittmer 1958:10-12; Laube 2007:49-53).

But those judicial tasks were to an increasing degree taken over by chiefs as time passed. The concept of chieftaincy was spread by the migrants who came as newcomers to the study area in the course of the 18th and early 19th century. Besides, there is also evidence that chieftaincy was at some few places also adopted from neighbouring territories by the old-established inhabitants of the area (Dittmer 1958). The division of labour between the *tindanas* and the chiefs was mostly uncomplicated: whereas the *tindanas* were still responsible for the control of the land and the related issues, the chiefs mainly took over tasks as judges with limited political power. The degree of a chief's political power was also determined by his individual capabilities to defend his people against slave raids and accordingly by his individual economic resources.

However, political power in the area never could reach a high degree of centrality and remained flexible as besides the chiefs also better-off farmers and capable fighters could gain some political influence (Laube 2007:52-53).

The beginning of the colonial era was foregone by a severe worsening of the life situation of the population in the study region that also affected the role of the chiefs. Besides the Mossi and the Dagombas, additionally the Zabarima started with slave raiding beginning most-likely in the late 1850s or early 1860s. The Zabarima were an ethnic group belonging to the Songhai, which in their majority today still settle in the Northern Sahelian area. Initially they mainly came to the Dagomba area as horse traders, but then they more and more helped the Dagombas to fulfil their slave tribute payments to the Ashanti kingdom[28] and appeared as slave raiders in the region. As time passed, the Zabarima defied the Dagombas' control and started raiding wide parts of today's Northern Ghana in their own interest. By doing so, they developed to a powerful force in the region. The defence against these violent intruders turned out to be increasingly difficult for the local population because firearms and horses became ever more widespread among the raiders in that time. The local defenders could still only encounter with bows and arrows so that they rather escaped to hilly and hardly accessible areas than tried to enforce the open battle. Even the Dagombas' support for some of the local chiefs in order to completely banish the former vassals of the Zabarimas from their sphere of influence could not really improve the situation for the local population (Howell 1997:28-32). The situation got even worse as it came to a devastating war between two Zabarima leaders about the supremacy over the area after the death of their old leader in 1880. The fighting parties tried to acquire the necessary resources for their troops by constant lootings of the already quite resource-poor region. When in 1890s Samori Toure and his Sofa troops entered the era in an attempt to resist against the expanding French imperialism in West-Africa by establishing an Islamic empire, the situation worsened once more.

The end of this war torn era came as French as well as British troops entered the region and finally could drive away the conflict parties in 1897. This was actually the basis for

[28] In the decades before 1874, which was the year when the British and the Ashanti kingdom signed the treaty of Formena, which forced the Ashanti to abandon large parts of their territory and to abolish slave trade, the kingdoms of Gonja and Dagomba had to send averagely 1,000 slaves per year to the Ashanti kingdom (Arhin 1974:100).

the later rule of the British over the study region since the influence zones between the two colonial empires were fixed as a result of the Fashoda crisis in 1898, which had almost led to a war between France and Great Britain. The arrangement making the 11° latitude the borderline between the two colonial powers' territorial interests in Africa declared the later so called Northern Territories as British influence zones after the British empire had made the Ashanti empire a protectorate two years ago. As the colonial troops were not able to permanently control the region, slave raids and lootings- now also undertaken by local raiders[29] - went on until the first decade of the 20th century. It was not before 1905, the year when the dreaded slave raider Bagoa was executed by British troops on the outskirts of Navrongo, that the era of slave raids in the study area had finally found its end (Laube 2007:54).

The decades of war and slave raids had a catastrophic effect on the research area. An unknown number of villages were destroyed, many inhabitants of the area were captured as slaves and got displaced or died and whole harvests were looted. The food stocks decreased sometimes even that far that the locally high important funeral ceremony in that time often could not be performed; large quantities of food being provided by the family of the deceased as well as collected by the attendants of the ceremony are traditionally needed for a funeral[30], which is separated from the burial of the deceased person. The dropping number of funerals had a very dramatic impact on the local population in spiritual terms since according to the traditional local beliefs, the spirits of the deceased who got buried without funeral ritual could become angry at the living and punish them, e.g. by poor harvests in the future. An important consequence of the whole development was that the local population developed a deep mistrust towards any kind of intruders and partly also antagonistic feelings towards neighbouring communities (Laube 2007:53). This resulted according to Howell (1997:32) in the

[29] As Howell (1997) reports, the local raiders mainly came from an area west from the Sisili river. Today, this area belongs to the Upper West Region. But there were also raids on neighboring settlements originating from communities like Sandema, Chiana or Navrongo. Raids were allegedly seen by the local looters 'as the only way they could survive' (Howell 1997:31).

[30] Funerals are until today very important social events in the study region, particularly the ones of older or very well known people. Similarly to marriages, funerals are prolonged and multi-stage processes, which are normally performed during the dry season. A funeral can take place even years after the burial of the deceased person. For a funeral, each section has to make some strictly pre-defined contributions in order to guarantee that the event can be very celebratory and big what of course also means that enough food and drinks for a large number of people needs to be provided. Accordingly, funerals are usually very costly - also for those households that have to make some contributions to the funeral house (Tonah 1993:67-68).

refusal of the study area's population to be largely involved in the trading activities of the Moshi traders, whose trade routes still crossed the Grushi territory. Furthermore, Howell assumes that the violent Islamic intruders in the second half of the 19th century had made the local population to become very sceptical towards the Islamic belief; in consequence, Islam itself never became very widespread among the Kassena and the Nankana. But also the British had to experience the deep mistrust against intruders when around 1900 colonial expedition forces were immediately attacked in several communities like Chiana or Sandema after entering the communities. The British responded harshly with the killing of involved warriors, the burning of houses or the taking livestock as reparation (Howell 1997:32-34).

However, another consequence of the devastating years of war, looting and slave raiding in the research area was that the power of the local chiefs as well as the traditional forms of political and social cooperation - both already not very strong in the pre-colonial time - had become very weak at the official beginning of British colonial rule over the study area. The British, who finally established the Northern Territories as British protectorate in January 1902, had the very difficult task to look for local ruling authorities who could function as partners in order to establish their system of indirect rule. This basically meant that colonial rule over a certain territory had to be established with the assistance or incorporation of traditional or local governance structures. The colonial masters solely focused on the chiefs as cooperation partners although they were disappointed about the usual low degree of authority the chiefs had in their areas. The British totally overlooked influential men besides the chiefs; for instance the local people who had been able to successfully organize resistance against the slave raiders. They also ignored that in many places the chiefs who were introduced to the British officers were not the real chiefs. Oftentimes the actual chiefs hided in fear and men of a rather low social status were introduced as chiefs to the British (Dittmer 1958:52). The indirect rule was furthermore established by a system of control and liability starting from village headman up to the chiefs. Those chiefs who refused to cooperate with the colonial administration were rigorously disempowered and immediately got substituted by others, even if those were massively lacking power and legitimacy. As a logical result of the British policy, many chiefs were not respected as such and their orders were correspondingly disregarded. The consequences for such acts of disregard were

quite strict because the administrations often punished this behaviour with imprisonment or severe administrative fines. Another problem associated with the enforcing of the indirect rule, was that some chiefs ignored the colonial administration's orders or they started to exploit their people for their very own benefits. Those chiefs were immediately replaced with other ones (Laube 2007:54-57).

The introduction of British indirect rule in the Northern Territories was culminating in the introduction of the 'Native Jurisdiction Act' in 1935. This act allowed the local chiefs to establish courts that had judicature in such areas of law and like land tenure, family law and question of succession. The establishment of indirect rule was also clearly aiming at an artificial formation of larger administrative and ethnical bodies. The concept of hierarchically structured and territorially clearly defined states was difficult in an area where chieftaincy - if it existed at all - mostly was not a very strong governance pattern and the power of chiefs was additionally limited due to the devastating years of war and slave raiding in the second half of the 19th century. Furthermore, the British definition of ethnically clearly defined (bigger) tribal states did not meet the situation in certain parts of Northern Territories as for instance the study region since the 'ethnic' identity was rather defined by small social formations determined by the patrilineal kinship, the neighbourhood and the clans. Due to the fact that the local communities had for centuries to rely on temporarily alternating alliances - which for instance also created traditional antagonisms between villages -, the introduction of larger tribal states was even more difficult. The resistance against the subordination under a certain chief remained severe in some places of the Northern Territories throughout the whole colonial time (Kunbour 2000:6).

Especially in the years after the introduction of the 'Native Jurisdiction Act', the chiefs could hold a lot of governmental power in their hands to the disadvantage of the *tindanas*. But this colonial policy of rolling back the power and influence of the earthpriests was intensified when the British began to tamper with the *tindanas'* very own best sphere of power and influence, which were and are of course land issues. In the very first days of the British rule over the Northern territories, an official announcement allowed colonial officials to require every piece of land if this is necessary for governmental issues. Although the announcement clearly stated that in other respects the land administration should be still lying in the hands of the native

authorities, the passage of authorisation for governmental land requisition was definitively illegal. In the early treaties with the British colonial power, the chiefs and the *tindana*s never assigned parts of their jurisdictional and land tenure rights to the colonial authorities. The 'Land and Native Rights Ordinance' from 1927 finally declared that all governmental and non-governmental land would now be under the control of the governor, who in principle could dispose of the land without any restrictions. The official announcement said that all land acquired under customary law should remain in the control of those people who obtained the land; although all native land was officially declared as public land in 1931 (which did not change until 1979). The ambiguous and partly confusing situation that on the one hand, the customary land laws and its related jurisdictional system had to be respected and on the other hand, the governor could effortlessly distribute land and even collect rents for it, further weakened the position of the earthpriests in many parts of the Northern Territories. The chiefs largely benefited from this development and received many privileges and rights - also in the area of land tenure -, which originally fell to the legitimate sphere of the *tindanas*. This shift of competences and rights to the advantage of the chiefs was thoroughly intended by the colonial administration as a majority of the British officials remained quite distrustful towards the earthpriests due to their 'pagan' practices, such as the pacifying the spirits of the land. As an important result of this power shift, land tenure in some places became a subject of parallel governance attempts of *tindanas* and chiefs (Laube 2007:56-57).

The chiefs' influence even grew further when the British administration created the so called house of chiefs, which had some influence on the colonial administration. But the chiefs were under strain after Ghana became independent in 1957 and Nkrumah and his ruling party showed more and more authoritarian and centralistic features. This had its peak in 1960 when the CPP was declared the only state party in Ghana. In the early post-independence phase, the Ghanaian state under Nkrumah, who wanted the chiefs to be degraded to 'passive agents of the government' (Brempong 2001:45), massively intervened in the chiefs' sphere of influence by cutting their revenues, by decreasing their influence on the local administrations and even by intervening in questions of chief successions. Not at least due to these interventions, especially the Northern chiefs, who were afraid that they could lose their power and privileges they had gained under the

colonial rule, as well as the Ashanti rulers were severely involved in the founding of the main opposition parties 'National Liberation Movement' and 'Northern Peoples Party', which were already founded before Ghana's independence (Lund 2003:590; Brempong 2001:47-48). But as more and more chiefs recognized that a strict opposition was quite senseless and cooperation with CPP could be even beneficial for themselves and their communities in terms of resource allocation or political support, the majority began to come to terms with the situation (Laube 2007:62-65). In the time of military reign after Nkrumah's overthrow in 1966, the chieftaincy was slowly restored and the chiefs retained their old power positions and privileges. This process was also underlined by the mentioning of the institution of chieftaincy and defining the related rights and duties in the three constitutions for the Republic of Ghana that were passed by the different governments in 1969, 1979 and especially in 1992 (Brempong 2001). But concerning the management of natural resources, the competition chiefs and (concerning land issues) *tindanas* in Northern Ghana had to face on part of the state bureaucracy and its related agencies grew within the years and decades after independence in certain sectors like infrastructure, town planning or irrigation schemes. This competition has not been existing in the sphere of ordinary peasant farming schemes; here the local *tindana* usually is the traditional governing institution for land tenure. But concerning irrigation schemes, such as the Tono irrigation project for instance, the diversity of institutions governing such a scheme contributed a lot to typical problems of mismanagement or corruption (Laube 2007:234-245).

The bonds of solidarity which still existed at the dawn of colonial rule between different sectional kinship groups - and were absolutely essential to take action to defend villages from violent intruders in order to guarantee the survival of whole communities - slowly disappeared. The introduction of chieftaincy has created:

'…a concept of power that cross-cuts concepts of ritual affiliation and voluntary association, which always lay at the heart of social coherence' (Laube 2007: 232).

Also the exposure of many labour migrants to the South and therefore also to 'modernity' (see the previous sub-chapter) as well as the expanding Christianity and the still ongoing integration of Northern Ghana into the world economy have contributed a lot to these patterns of institutional change.

The institutional setting of the local societies changed reciprocal solidarity patterns to become a rather inner-sectional phenomenon. The grade of reciprocity and cooperation is the strongest within a compound and between different compounds of one sub-section whereas not only the patrilineal bonds, but also affinal ties may be of a great importance with regard to reciprocity and cooperation. However, also on the sub-sectional and sectional level, reciprocity exists as regards sharing of land, food, money, labour force or funeral grants. Although these altruistic norms are of importance in the local society, this does not imply that people are necessarily very happy as for instance they are asked to share their often very scarce and hard-earned money with others. The redistribution of resources is to an increasing degree being perceived as a restraint for the individual economic and financial development. The consequences are that many locals start dodging or try to pay as less as possible when a relative approaches them e.g. to ask for some food or money. This of course leads to more conflicts, jealousy, permanent negotiations and competition among local peasants The violation of altruistic norms can on the other hand lead to a sanction by the elders or by the chiefs (Laube 2007:131-132).

Chapter summary

This chapter has given an overview of the study area. It became apparent that the study region is undergoing processes of ecological change like changing rainfall patterns or soil degradation in some areas. These processes are not only associated with climate change but also induced by the local socio-economic and demographic conditions. Environmental change has a crucial impact on the local peasants' agriculture and increases the need to adapt the local livelihoods. Mainly to overcome the problems of food shortages but also due to diverse other reasons, the population in Northern Ghana has adopted seasonal and more permanent forms of migration to Southern Ghana as an adaptive strategy. Besides the economic approval of migration - mainly based on the absence of one or more food consumers in the households (and to a lesser degree certainly also on the sending of financial and food remittances) -, a cultural appreciation has emerged with the years. This cultural appreciation is based on the fact that migrants for decades have imported 'modern' knowledge and items to their home communities. Through the decades, not only migration trends have changed again and again, also the patterns of social cooperation and organisation, which - as it will be shown in the following - are a key element for local adaptation processes, were ever the object of changes. As a consequence of the colonially enforced introduction of chieftaincy as well as due to other interferences of the British colonial power with local governance structures, social cooperation and reciprocal solidarity has become weaker. However, altruistic norms still exist, but nowadays they are stronger on the compound level than on the higher levels of social organisation.

V Shallow groundwater irrigation farming as adaptive strategy

Irrigation farming by itself is nothing new and nothing very special in the study area (see chapter IV.2). The construction of medium-scale dams in Tono and Vea as well as the construction of about 200 small dams in the Upper East Region were associated with high costs and raised a lot of attention as Tono for instance is the largest irrigation scheme in Ghana. But the capacities of the irrigation schemes in the Upper East Region as adaptive instruments to reduce the pressure on the farmers' livelihoods were and are very limited and assigned to a lot of problems. First of all, the management structures of the irrigation projects were characterised by co-existing stately and traditional institutions with partly overlapping competences. The resulting legal pluralism created a lot of problems like corruption, inefficient use of water resources, nepotism and open conflicts, which were mainly deriving from the low degree of legitimacy the newly created state agencies were holding. Additionally, the poor construction quality of many dams led to a quick abandonment of irrigation farming at many sites; even though many dams were rehabilitated since the early 1990s. The probably most severe reason concerning the question why the irrigation schemes remain quite limited as an adaptation strategy is that the number of farmers in these schemes still is very limited, despite the almost amazingly high number of constructed dams (Laube et al. 2008:10). On the contrary, small-scale irrigation farming along the dry riverbeds during the dry season could attract thousands of farmers, who by now cultivate thousands of hectares, especially within the last one-and-a-half decades. Compared to the irrigation farming at the dam sides, SGI farming has a very high degree of institutional legitimacy.

The following chapter focuses on the aspect of SGI as innovative process, whose dynamics and drivers shall be analyzed based on theoretical discourses on peasants and their innovative and alleged risk-taking or -avoiding behaviour. As it will be shown in the following part of the thesis, the embeddedness of SGI in the local institutions - or more precisely: in the local system of values and norms - is a major key and 'catalyser' for its rapid growth within the last years. This kind of irrigation farming has therefore

largely contributed to an enhancement of adaptive and poverty diminishing capacities of the accordant households.

V.1 Shallow groundwater irrigation farming as an agricultural innovation process

The theoretical considerations regarding SGI as an agricultural innovation process address mainly the question about agricultural smallholders and their willingness to take, avoid or manage risks, which are necessarily associated with the adoption of a new cultivation form. Furthermore and related to those considerations, the theoretical discourse in this section has to deal with the peasants' attitudes towards profit-maximizing and market issues because vegetable cultivation via SGI is - at least in the form it has spread throughout the late 1990s and 2000s - a clear market-oriented cultivation form.

The innovation- and risk-averse peasant?

In the very early considerations on development perspectives for the then freshly independent developing countries, proponents of the classical modernization theory like Rostow (1960) accounted the institutions and collective mentalities of an agricultural or traditional society (in particular a non-profit-orientated way of thinking) as major obstacles to the development of Third World countries. Industrialization and increased world market integration were seen as standard recipe to development and modernization. In other words: the agricultural societies of the developing world should adopt successful modernization pathways of the West-European and North-American countries, which resulted from initial industrialization processes in the late 18th and early 19th century. In the 1960s, there was an emerging criticism on this theory; scientists like Frank (1967) or Wallerstein (1974) blamed continued neo-colonial exploitation via an unfair world trade system or the negative development of the terms of trade for developing countries as major reasons for underdevelopment. The theorists of the dependency theory regarded Northern America and Western Europe as the centres, whose economic and political needs and objectives are the main determinants

for social change in the still dependent developing countries, which they defined as periphery. The supporters of this theory had much different ideas of how to develop the developing countries; they primarily recommended a promotion and protection of the periphery countries' own industries as well as the displacement of foreign investment in those countries.

Amongst other reasons, the inability of these structural-analytic models to explain certain phenomena and developments in developing countries led to a shift to rather actor-oriented approaches. In this context, the question of the internal dynamics of peasant norms and values and the peculiar rationalities of agricultural smallholders gained more attention. Within the South-East-Asian context, Scott (1976) developed the idea of the existence of a 'moral economy of the peasant'. Influenced by Roumasset (1976:37-41), Scott's basic idea is that peasants avoid risky investments although they have the potential of good returns. But a small-scale farmer is endangering his and his household's existence in case that such investments end up with a loss; this would probably make it impossible for him to reinvest into the inputs for the vitally important subsistence farming. This 'safety-first' principle is seen as the peasants' major determinant of their economic behaviour with the (in this context very important) consequence that there is hardly space for agricultural innovation, especially when those innovations are risky. According to Scott's (1976:20-23) rather strict interpretation of the safety-first rule, peasant producers prefer the cultivation of edible subsistence crops, even when the cultivation of (non-edible) cash-crops may result in high profit margins. In this context, the diversification of the plant variety under cultivation, share tenancy or the cultivation of different plots at the same time are interpreted as further strategies for peasants to manage or mitigate their production risks.

Scott and also Hyden (1983), who virtually applied the 'moral economy' concept to African circumstances ('economy of affection'), describe the peasant society as a system of strict norms and rules ('a moral universe' (Lemarchand 1989:35)). Especially in Hyden's studies, the peasant is described as an individual who is less interested in personal profit maximizing but more in the fulfilment of supportive duties towards a security-maximizing reciprocal network 'connected by blood, kin, community or rather affinities, for example religion' (Hyden 1983:8). This network is not made up of pure, reciprocal altruism, but it rather can be understood as a collective crisis prevention and

compensation strategy enabling farmers to withdraw from a forceful market integration and agricultural modernization. This pillar of the moral economy concept, which can be summarised as the ethic of reciprocity, can also explain the existence of such activities like share cropping or other rather non-monetary forms of resource allocation and the provision of access to it. The ethic of reciprocity also embraces non-production related assistance in form of food donations or taking care of relatives in times of need (Scott 1976). (Forceful) world market integration accompanied by being subjected to commercial agriculture schemes are in this context regarded as threats to the traditional ethic of reciprocity as well as to the ethic of subsistence (Feeney 1983). Scott (1976) interpreted violent riots and rebellions, which for instance appeared in wide parts of Vietnam or Burma in the 1930s, as reactions towards the forced integration into the world economy by the colonial powers.

Rational choice related critics of the moral economy concept like Popkin (1979) (in response to Scott) and Bates (1981) (in response to Hyden) underlined that individual rationality may rule out collective rationality. To put it more precisely: one could say that despite all reciprocal solidarity bonds, peasants act in an individualistic profit maximizing way in case that there are benefiting circumstances in the overall socio-political environment. Bates analysed in his comparative study of several African countries (including Ghana) how post-colonial governments in sub-Saharan Africa attempted to control the markets of agricultural produces and inputs as well as the markets for durable goods. He comes to the conclusion that peasants refrain from innovative farm practices predominantly due to the reason that they want to avoid exploitation from the state or local elites.

A classical example for such an innovation-friendly socio-political environment is the rapid diffusion of cocoa farming in the British colony Gold Coast - the pre-colonial Ghana - in the late 19th and early 20th century.[31] Cocoa cultivation was pushed by migrant farmers and not by forceful interventions of the colonial administration. The migrants mainly came from the Southern part of the country and moved to the central regions of the colony. Main reasons for moving there was their will to find a place for growing cash crops, land pressures they faced in their home regions and intact market

[31] From 1892 to 1911, the shipments of cocoa from the Gold Coast increased from zero to approximately 400.000 tons a year (Hopkins 1973:216).

channels in their new farming areas due to infrastructural improvements and high overseas demand (Hill 1963). A more recent example of small-scale farmers who very actively use emerging markets for their own purposes is the rapid diffusion of pineapple growing in Central Ghana in the 1990s (Conley and Udry 2001).

Lemarchand (1989) formulates a concluding compromise between the conflicting positions on peasants and their attitudes towards market integration and modernization; he described the process whether a peasant engages in innovative technologies with the aim to earn cash income as a welfare function: the social costs entailed by possible disregards of social obligations must be calculated against the advantages of a cash income. Those risk factors are calculated 'along with the imperative of the subsistence ethic, then, the ethic of social obligations to clan, client or kin' (Lemarchand 1989: 58). Furthermore, Feeney (1983:770-773) criticizes that the alleged measures of risk avoiding and risk mitigation like share tenancy, intercropping cultivation or others are not necessarily undertaken only out of risk avoidance considerations. For instance, plant and plot diversification can also be undertaken because different plots have different soil characteristics. Also the alleged affinity of many peasants towards subsistence crop cultivation, which is chosen over cash crop cultivation, has ever attracted a lot of criticism.

In summary, it can be stated that peasants may adopt a market-oriented innovation in case that: (1) a profit perspective is given - indicating the existence of more or less adequate market channels -, (2) the risks associated with an innovation are somehow manageable, (3) the associated social costs are not too high and (4) the socio-political framework is not supporting exploitative mechanisms. As it will be described in the following parts of this chapter, these preconditions can also be found in the study region.

In the 1990s, the international research on development issues shifted its focus largely from the debate on internal dynamics of smallholder social institutions and their effects on agricultural development. After years in which agriculture was not a crucial topic in the international development agenda, the focus of many development donor agencies as the World Bank went back to agricultural subject matters - especially in Sub Saharan Africa (World Bank 2007). Fairhead and Leach (2005) suggest that in this context there

is the need of a renaissance of the debate on the social aspects of peasant agriculture, particularly in times when African smallholder agriculture is facing severe challenges but its potential for domestic food supplies and internal as well as export-oriented markets at the same time are being recognized as key element for an improvement of the overall agricultural performance in Sub-Saharan African countries (Toulmin and Guèye 2005).

Who are the agricultural innovators and why do they innovate?

Agricultural innovation is said to be the key element for the improvement of the livelihoods of peasant farmers in Sub-Saharan Africa. For a long time, the focus on agricultural innovation was on the adoption of technologies brought from the outside to farmer communities; or in other words on a technology transfer model. Technologies and improved adaptation practices developed by the farmers themselves have hardly been considered for a long time. In the late 1980s and 1990s, a shift from modernization-theory driven top-down intervention to a grassroots perspective emerged. With the publications of Richards (1985) or Chambers et al. (1989), the topics of indigenous farmers' knowledge and related farmers' experimentation or farmer driven innovation processes became more and more part of the focus of international research agendas. The pragmatic aspects of this paradigm shift are according to Waters-Bayer et al. (2006:4-5) obvious because due to the enormous variety of ecological, socio-cultural and economic conditions of each farming system, it is impossible to develop innovation-specific adaptation solutions for all of these systems from the science' perspective. Especially under the conditions of the mentioned 'double-exposure' (O'Brien and Leichenko 2000) to both ever expanding global markets and environmental changes, the resulting constant change of conditions for small-scale farming in Sub-Saharan Africa makes the observation of farmer driven agricultural innovation processes even more urgent and important.

Important initial points of every innovation are necessarily those who begin with an innovation in their local contexts. The questions arise: what characteristics do these innovators have in common, what is their motivation and where do they take their knowledge from. In the following, particular characteristics and motivations of African

agricultural innovators in a general perspective and the innovators' characteristics and motivations in the study region will be described.

In his influential study, Rogers (1995) developed a five stage time model for the sequence for the diffusion of innovations. It distinguishes between five different adopter groups with certain socio-economic characteristics: the innovators, the early adopters, the early majority, the late majority and the laggards. The innovators are described as venturesome and risk-aware. Furthermore, they are wealthy and therefore in control of sufficient financial resources allowing them to compensate possible losses from an unprofitable innovation. Moreover, they have a higher educational level than the average and the rest of the innovation related population. The early adopters are regarded as successful opinion leaders and role models, who are also highly respected by peers; the early majority however, is more risk-averse and very hesitant before a new idea gets adopted. But the members of this group frequently interact with their peers. The members of the late majority are said to be cautious and sceptical. They usually only adopt an innovative technology as a reaction to pressure from outside or strong economic necessity while the last group, the laggards, are considered as isolated, highly risk-averse individuals without any kind of opinion leadership.

The adaptability of Rogers' model, which is largely based on an article of Bohlen and Beal (1957) on the adoption of hybrid seed corn in the US state of Iowa in the 1950s, to the circumstances of an African peasant community is quite questionable - possibly except the individual degree of risk-avoidance. Based on empirical evidence on Maya agricultural smallholder communities, Cancian (1979) comes to the conclusion that in contrast to Rogers' model not the wealthiest farmers are necessarily the innovators but rather the lower-middle ranking ones, which is explained with the circumstance that the latter are seeking for a higher social rank and more wealth. This quest can lead to a partial overruling of risk-avoidance. However, attempts to theoretically explain which socio-economic peasant stratum is more or less innovative than others and why are in an overall perspective rather heterogeneous and partly very contradictory (Feeney 1983:770-773).

More helpful in this context is the comparative analysis of agricultural innovators' characteristics and their motivations in several African countries (e.g. Burkina Faso,

Ethiopia, Tanzania) by Reij and Waters-Bayer (2001). First of all, the authors come to the results that many African innovators are men, especially when the innovation is referring to farming in a narrow sense. But activities like livestock keeping or food processing are in wide parts of Africa economic spheres, where women have a high degree of decision making power; female innovators can therefore definitively be found to an increasing degree. Moreover, many innovators in Sub-Saharan Africa, who are mostly full-time farmers, are described as already quite experienced in agricultural terms (and are accordingly of a rather middle or even older age) before they start innovating. As Nielsen (2001) has found out in a study on farm innovators in Ethiopia, many farmers do usually not start innovating before they have reached an age of about 35 years. In contrast to Rogers' model, Reij and Waters-Bayer state that innovators on average are not formally higher educated than their fellow farmers. Ouedraogo and Sawadogo (2001) have identified predominantly illiterate farmers as innovators and active promoters of improved soil quality recovering techniques ('zaï') in Burkina Faso. Rogers' finding that innovators are economically better-off than the average of their peers can also in this case not be validated. In the studies mentioned, many innovators got relatively rich as result of their innovations but financial means were not a necessary pre-condition for their innovations (Reij and Waters-Bayer 2001).

In the study region, we can also find some of the characteristics which were empirically identified above. The educational level of innovators of the study region is likewise not significantly higher than the average of the North-Ghanaian peasants; this means that most of the innovators never went to school. In the Anayare catchment, the irrigation innovators and their knowledge came from villages belonging to the community of Pungu, where a (dry season) garden culture already has had a long tradition (see also chapter IV.2). According to oral histories of some local farmers in the 1960s, some of the farmers in Pungu had to face severe problems with their home gardens. The reasons were that mango trees imported from South Ghana occupied too much land and soil erosion in the gardens was constantly increasing. They decided to start dry season farming with bucket irrigation at plots at the Anayare riverbed close to Mirigu. From there the dry season cultivation further spread north- and southwards (see box V.1 for a description on how SGI farming works).

Box V.1: How does shallow groundwater irrigation work?

Photo b.1: Motor pump at a dugout in the dry riverbed of the Atankwidi river

Source: Wolfram Laube

SGI farmers in the study region have their irrigated vegetable gardens along the river beds of the Anayere and Atankwidi rivers. During the dry season, the rivers fall completely dry. Along the dry riverbeds, farmers take the riverine shallow groundwater as irrigation water source, which they harvest from wells dug on the riverine plots or from dugouts directly located in the riverbeds. While the shallow groundwater table in the riverbeds is very low (often directly beneath the bed's surface; see photo b.1), it can range from less than two to more than 5 metres on the plots. Generally, the hydrological as well as the geological conditions can widely differ, even within a small river catchment area (see sub-chapter V.3). As photo b.1 is showing, the water is being pumped from the dugouts with a motor pump on the plots, which are usually located directly next to the riverbed.

Photo b.2: Farmer digging a well on a riverine plot

Source: Wolfram Laube

Wells used for irrigation purposes are being dug on plots that are also close to the riverside (see photo b.2). The water harvested from wells is pulled up with buckets and ropes. In both irrigation kinds, bucket/well and pump/dugout irrigation, the water is poured into cultivation beds the plots are being cluttered with (see photo b.3). On bigger plots, the number of beds can be more than thousands resulting in hard irrigation work, especially for bucket farmers. Further details on SGI are described in the following sub-chapter.

Photo b.3: SGI plot with beds

Source: Wolfram Laube

For the Atankwidi catchment, the innovators' knowledge in some cases came from labour migration stays in the farming areas of southern Ghana, but many innovators in the catchment area were farmers in the medium- or large-scale irrigation schemes in the region and could learn about irrigation cultivation there. Due to problems with the irrigation bureaucracy at the large irrigation sites in Tono or Vea or due to lacking access to appropriate land and water and partly inspired by the small-scale irrigation development in the Anayare catchment and the ever improving marketing situation for tomatoes, they decided to start dry season farming at riverine plots in the Atankwidi area (see box V.2 for a typical 'innovator story'). Seasonal migration was not really an alternative for cash income earning. The risks connected with seasonal migration stays in the South like the low availability of jobs have increased (see chapter VII.3). Additionally, as a (household) life cycle is associated with seasonal migration, the upper age limit for the migrants is about 45 years. That is why many farmers who had to abandon seasonal migration (mainly) due to family responsibilities had to look for a new way of earning cash income with irrigation farming.

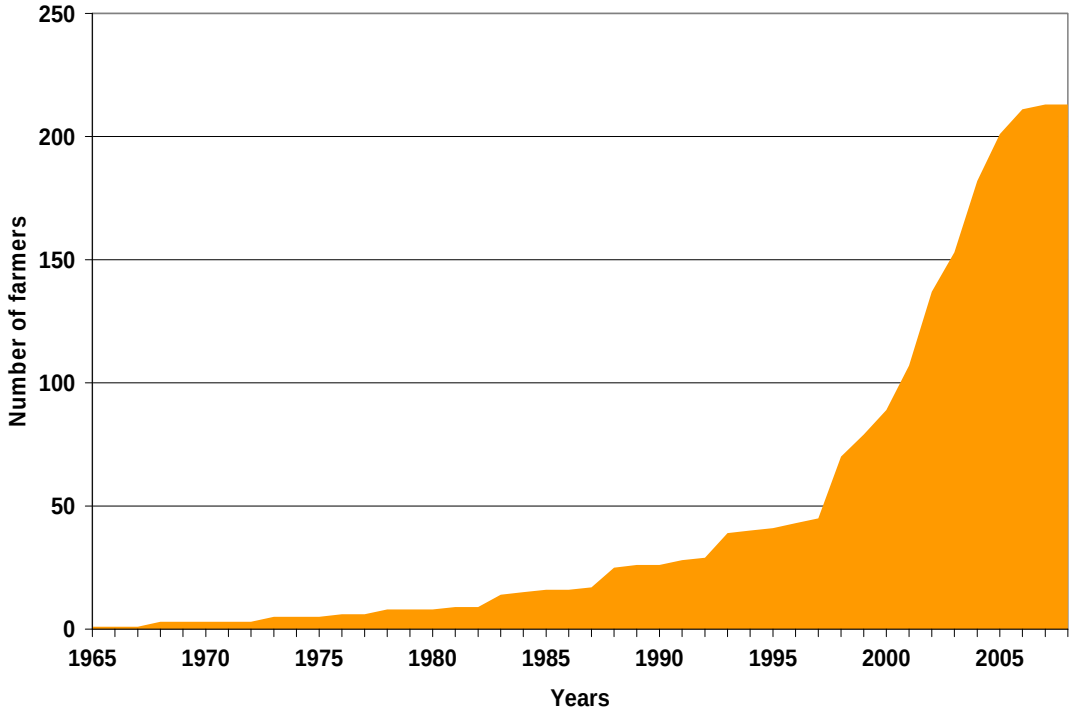
However, most farms were and are close to their homes (usually not more than about three kilometres away) in villages belonging to the communities of Kandiga and Sumbrungu. In the Atankwidi area, several innovators started at different sites during the mid 1990s of the river and each of them started to attract further farmers to join. Although the irrigation sites at Tono and Vea could already attract tomato traders during the 1970s and 1980s, small-scale irrigation farmers from both catchment areas profited from infrastructural improvements during the 1980s and 1990s being made in Central and Northern Ghana. They made it more worthwhile and also less risky for South-Ghanaian traders to come with their lorries to the North to buy the local tomatoes, which is until today by far the most important cash crop for the farmers in the area. In particular the rehabilitation of the road connecting Kumasi with Bolgatanga, Navrongo and Paga, which started in 1992 and was completed in 1997, was an important contribution for this development. This is also reflected in figure V.1: being asked about the year a farmer has started with SGI in the dry season, a clear increase of the number of farmers is observable in the second half of the 1990s: although it will not be concealed that this depiction is of course in demographic terms slightly 'distorted', many of those farmers who have started irrigation farming for instance in the 1960s or

1970s have meanwhile abandoned it, e.g. due to their old age or due to the fact that they are simply dead meanwhile. It can therefore be assumed that if continuous records existed on the number of farmers who have adopted SGI within the last decades until today, the curve would be more flat than the one depicted below. Interestingly, the average age as from which farmers started with irrigation farming is according to the surveys being conducted in the study area in accordance with Reij's and Waters-Bayer's (2001) all-African study about 35 years; this supports the thesis that innovators gain experience and knowledge before they start innovating.

Box V.2: An innovator's short story

John A. (60) from Kandiga has learned about irrigation farming in a small reservoir close to his home in the mid 1970s. About ten years later, he had the chance to purchase a plot at the Tono Irrigation Project, the largest irrigation side in the area. After some time, he was getting more and more into trouble with the local irrigation bureaucracy in Tono. Around 1990, John A. observed some partly related farmers in the community of Doba, who cultivated tomatoes via SGI. As he saw that they could sell their tomatoes at quite good prices, he decided to learn about SGI from them. In the dry season 1992/1993, John A. and four other farmers in his home community of Bembissi (part of Kandiga) started with SGI-based tomato cultivation at some closely related riverside plots at the Atankwidi river close to their homes. The four other irrigation farmers learned about the irrigation technique from John A. via observing and direct advising. After about two or three dry seasons, John's and the other farmers' irrigation plots attracted more and more attention in their community as it became well known that they meanwhile could sell their tomatoes to South-Ghanaian traders for comparatively high amounts of money. Accordingly, many other farmers also got some plots at the riverside (or already owned them) and learned about SGI from John and the other innovators. From there, SGI spread in Northern and Southern direction along the course of the Atankwidi river.

Figure V.1: Years in which interviewed farmers have started with riverine SGI farming in the study area (2008; accumulated)



Source: own computation; n=213

The massive growth rate for shallow ground water irrigation can also be explained with the relatively low input costs - at least for bucket irrigation. The costs for fertilizers, seedlings or materials, such as buckets, are comparably low. Most of the farmers in the study region have financed their first time of shallow groundwater dry season farming with the sale of animals or the sale of surplus rainy season farm produce (see table V.1).

Table V.1: Sources of capital used for investment during the first time of shallow groundwater farming (2008)

Sales of animals	41.5%
Sales of surplus rainy season farm proceeds	26.8%
Money was borrowed	8.5%
No money was needed	7.3%
Sales of both, animals and farm proceeds	6.1%
Income from off-farm activities	4.9%
Income from seasonal migration	4.9%

Source: own presentation; n=213

Principally, the input costs could even be reduced to zero because for instance seeds can be washed out from fruits and chemical fertilizers can completely be replaced with manure, which is on the other hand not very widespread in the study region. Only for the pump farmers, the input costs are constantly high: as their farms are bigger, pumps have to be bought or hired and fuel costs have to be paid. The average input costs for pump farmers are therefore according to the data from the 2008 SGI survey on average almost four times higher than the ones for the bucket farmers (see table V.2).

Table V.2: Mean input costs for bucket and pump irrigation farmers (2008) [32]

	Mean	Std. deviation
Bucket irrigation farmers	1,147,520 (= EUR 88)	1,179,825
Pump irrigation farmers	4,293,828 (= EUR 331)	3,034,935

Source: own presentation; n=213

[32] The values in EUR were calculated with the accordant exchange rate for July 31st 2007, which is based on information from www.oanda.com.

But the fact that input costs are low does not answer the general question why farmers start innovating. Regarding the concrete answer to this question for the study region it was already mentioned that the main motivational factor in the study region to start with riverine small-scale irrigation was the earning of cash income in order to maintain the food security situation of the innovators' households but also to make other security investments, particularly in livestock. Furthermore, the income is also invested in means of transport or school education for the children.

Again we find interesting coincidences with these findings in innovation literature as it is clear that a central motivational factor for agricultural innovation generally is the need to secure the household's food security via mainly an increased cultivation of cash crops due to environmental or climate change processes (Reij and Waters-Bayer 2001). Like for other adaptation processes, besides ecological reasons also socio-economic or political reasons have been widely detected as drivers of farmer driven innovation processes (Saad 2002:11-12): when for instance as a result of armed conflicts refugees are entering a new area, they have to adapt to the new environment. This may also apply to areas with changing market structures. Another factor to possibly increase the innovation probability can be the close contact of farmers to formal or participatory agricultural research: Amanor (1993:39-43) shows with an example of a farmer survey in South-Eastern Ghana that the degree of experimental innovation is higher in those places where farmers have a closer contact to model farms in their area. But also simple curiosity, cultural or even spiritual reasons have been detected as a peasant motivation for innovative experimentation (Millar 1993).

However, the knowledge or inspiration sources for farmer innovators are very manifold; Reij and Waters-Bayer (2001) make the conclusion that many of the innovators have received valuable ideas for future innovations when they were staying away from their home areas in different agricultural areas - like in the study area, where the innovators gained their knowledge as migrants in Southern Ghana or at the Northern irrigation schemes. GebreMichael (2001) shows that many farmers in Ethiopia, who have started innovating with soil and water conservation techniques, were former soldiers; they have transferred the ideas, they were introduced to or just observed during their military time, to their home surroundings.

Photo V.1: Irrigation dugouts in the dry riverbed of the Atankwidi river

Source: own photo

As knowledge cannot be just transferred from one context to another but needs to be 'localized' or - in other words - needs to be adapted to the new local environment (Evers and Gerke 2005:82), local innovators have to adjust their knowledge to the new environment although they already have some knowledge about an innovation. It is well documented that experimentation in diverse forms (e.g. jointly or individual) may not only be an origin of an innovation, but it is also the key for the local adoption of innovations coming from outside (Saad 2002:5-7) whereas the localization of an innovation may lead to the creation of new knowledge. Also the North-Ghanaian small scale irrigation innovators had to find optimal places to dig wells for instance. This task obviously was not necessary in the irrigation schemes. With 'trial and error'-oriented experimentation on this, they also created new local knowledge that was in turn used and also slightly modified from the following adopters of small-scale irrigation. The

same knowledge creation mechanism took place as with the time some farmers could also raise the necessary funds to start using motor pumps for irrigation (see Photo V.1).

Farmers learning from farmers - the moral economy of knowledge sharing

It has been pointed out how innovation related knowledge can be generated. The more crucial question at this point is how this knowledge is accessed by later adopters or how this knowledge is spread from the innovators to and among the later adopters of an innovation. Historical studies from colonial Ghana, for instance conducted on the spreading of cocoa cultivation in the late 19th and early 20th century (Hill 1963) as well as more recent studies on pineapple growing (Conley and Udry 2004) underline that successful knowledge dissemination processes related to farmer driven agricultural innovations are largely based on more or less direct farmer to farmer knowledge exchange mechanisms. These social learning processes can be observed in other parts of Sub-Saharan Africa as well; e.g. in the case of the so called *bani* or *dambo* irrigation in Southern Africa, which is also a form of small-scale irrigation (Makombe et al. 2001). Crucial factors in those studies on African farmer driven innovation processes mentioned above are that social learning is based on knowledge dissemination within social networks via observation-imitation mechanisms, direct face-to-face knowledge sharing as well as the farmers' willingness to share their knowledge with their peers.

Concerning the willingness to share knowledge, Chay et al. (2005) have identified several conditions for the sharing of knowledge within organizations. Given the assumption of reciprocal solidarity bonds between peasants in a benefiting environment (see above), some of the conditions can be transferred to this situation. These conditions for knowledge sharing are *expectations of the costs (of not sharing knowledge)*, *expectations of the benefits*, *context compatibility*, *opportunities to do so* and *communication modality*.

The expectations of the costs of not sharing knowledge are perhaps the most crucial condition in a farmer driven innovation process. This condition goes back to Knights et al. (1993) and is assuming that knowledge is involuntary shared, even in the case that there is no direct benefit for an individual but the consequences of not sharing could be very severe. In a situation when reciprocal solidarity is still of an essential meaning for

coping with hardships - and refused solidarity can even be sanctioned (see chapter IV.4) -, the consequences for not disseminating their knowledge for innovators could be a loss of solidarity, maybe even in a situation where it would be needed the most. This knowledge sharing behaviour is documented by GebreMichael (2001), who has shown that in Northern Ethiopia in particular farm innovators with a poor or a middle wealth status actively shared their knowledge about soil and water conservation with other farmers.

The innovators in the study region describe the dissemination of their knowledge as a social obligation. One of the first farmers who started with small-scale irrigation in the Atankwidi catchment describes his typical attitude on the sharing of knowledge with other farmers, who were interested in learning about this irrigation kind, with the following words:

'I perceive them as my ancestral children [*Nyaaba komma*]. That means that I have to take care of them. I have to assure that they also can better take care of themselves and their families during the dry season.' (Interview with Adorse A. (70), Kandiga, 27.03.2008)

Another farmer puts it like that:

'It is a duty to do so because I am satisfied when others can earn their daily bread so properly as I can do it'. (Interview with John A. (60), Kandiga, 26.03.2008)

In general, the knowledge sharing related condition of the expectation of the benefits refers to rewards, which an individual would receive when he or she engages in knowledge sharing. The benefits that a peasant innovator can receive are according to Reij and Waters-Bayer (2001) an increased social esteem. When social bonds are still of an essential meaning, this is certainly not only a sample post but rather an investment for their security. The benefits for the adopters or knowledge receivers are context-specific and manifold, but according to Griliches (1957:517-520) or Feder et al. (1985) particularly the profitability of an innovation can be a major benefit of the crucial motivational factor for the uptake of it.

Directly associated with the expectation of the benefits is also the condition of context compatibility. In the literature on knowledge sharing in organizations, this condition has

the assumption that individuals who have certain similarities like common values or work interests that create a certain feeling of affection are more likely to share knowledge with each other than individuals who do not have these similarities. This resembles obviously the mentioned (kinship-based) social networks chosen as platforms of knowledge exchange among African peasants and as platforms of general social solidarity as well.

Conley and Udry (2001) have underlined that the amount of information that a (potential) adopter receives is crucial for a successful adoption in the setting of a farmer driven innovation processes. This leads directly to the knowledge sharing conditions of 'the opportunities to do so' (to share knowledge) and the communication modality to determine the successful transfer of knowledge and therefore also the related adoption as such. The way of how farmers organize knowledge exchange is a so far in the socio-scientific literature widely neglected research field. A good example for how astonishingly creative and active farmers can be in overcoming information losses and in finding good communication modalities for sharing their knowledge with their peers can be found in the already mentioned case of the spreading of improved zaï techniques in Burkina Faso.[33] Ouedraogo and Sawadogo (2001) have identified three different general modes of how farmers (self-)organize knowledge dissemination.

In the first model, which could also be called a 'knowledge-imparting platform', one farmer started to organize special market days twice a year on his own account, predominantly with the aim to give farmers the opportunity to share their experiences and to impart their knowledge about improved zaï technology. In the first market day, which usually takes place shortly after the harvest at the end of the rainy season, farmers bring also samples of their crop varieties. These samples are then stored at the organiser's farm and brought back to the second market day before the next rainy season. That way a cultivation selection by the farmers under (mostly) improved growing conditions is enabled as the result of the previous knowledge exchange.

[33] A zaï is a pit that is dug into degraded soils. The zaï pits, which have a diameter of 20-30 cm and a depth of 10-20 cm, are filled with organic matters. These pits attract termites that improve the soil structure by digging channels. This increases the water infiltration as well as the nutrient availability for plant roots (Ouedraogo and Sawadogo 2001). Improved zaï methods are said to be a highly efficient technology to rehabilitate degraded soils especially in the Sahel area (Fatondji 2002).

The second model, the ‘zaï school’, is a joint ‘learning by doing’ dissemination way. Here, the innovator decided to train some fellow farmers in how to re-cultivate a largely degraded piece of land with an improved zaï technique. The group collectively worked on one piece of land and could achieve a very good yield to be shared by the whole ‘zaï school’ community. The good harvest result also attracted further farmers to learn more about improved zaï cultivation.

In the last model, the ‘teacher-student’ model, a farmer innovator started to impart his gained knowledge about zaï improvements by visiting other farmers in his region on their individual farms on a regular basis. He showed them his improvements not only by giving them advice or experience exchange but also in practical terms by working together with his fellow farmers on their farms. The so trained farmers in turn started to experiment with zaï improvements on their own and also began to train other farmers on their cultivation areas.

The dissemination kind that farmers have established in the study region is similar to the last mentioned model. The majority of farmers who initially wanted to adopt small-scale irrigation cultivated plots close to the plots of an innovator. That gave them the opportunity to observe the different steps of tomato cultivation and irrigation and also work together with their ‘teacher’ on his field with the purpose of an active form of ‘learning by doing’. With the time, the social learning process developed more and more a strong family component because many children directly learned the dry season farming from their fathers, older brothers or other relatives within their (sub-) sections. As table V.3 shows, almost 80% of the recent irrigation farmers have learned about this technique from their fathers or from other relatives. But there are also farmers who went to distant relatives or acquaintances in other farming areas to learn about riverine irrigation to start it later on their own. So, the related knowledge spreading dynamics partly have exceeded the boundaries of the smaller local communities.

Table V.3: Sources of irrigation related knowledge for irrigation farmers (2006)

Fathers	23.9%
Brother(s)	19.7%
Other relatives (including husbands) or friends	33.8%
Other farmers	9.4%
Own experience	9.4%
An official source (irrigation projects, etc.)	2.3%
Another source	1.4%

Source: own computation, n=213

Contrary to the spreading of improved zaï methods in Burkina Faso, riverine small-scale irrigation in Northern Ghana could never attract higher attention of the Ghanaian Government or NGOs; consequently, there was also no big support to the farmers, e.g. being provided by the Ministry of Agriculture. So far, the whole innovation process remains a completely farmer-driven development.

The expansion process of SGI was rather supported by the fact that the knowledge barrier for dry season tomato farming is rather low; many of the cultivation steps for tomato farming are very similar to rainy season farming techniques. So, much of the dry season farming like the initial land clearing was already part of the (tacit) farming knowledge of the adopters of small-scale irrigation farming. Modes that really had to be learnt were solely the making of irrigation beds, transplanting steps, watering sequences, shading and tomato-specific fertilizer application. A farmer who was also one of the innovators in the Atankwidi catchment describes this issue in the following way:

‘It is not hard to learn tomato cultivation when you are already a farmer. Many of the necessary things are already known to you then.’ (Interview with Awaala A. (67), Kandiga, 28.03.2008)

The increasing attention that African agriculture has (re-)gained within the last years leads to a (re-) consideration of the question of how to evaluate the effects that African

small-scale farmers' social networks have on agricultural development. It can be taken as a well documented fact that these reciprocal solidarity bonds inherent in a peasant community are not hindering agricultural innovation processes. As it was (a) theoretically shown by a combination of functioning solidarity bonds with the mentioned necessary conditions of knowledge sharing and (b) empirically underlined with the description of SGI related knowledge sharing mechanisms in the study, one can go one step further and say that these bonds or networks can even be a driver for innovation processes. Surely there is the need for further empirical evidence regarding the supportive functions of social solidarity bonds for innovation and adaptation processes. Particularly the ways of how agricultural smallholders are organizing knowledge exchange about innovative agricultural techniques have to be further documented and analysed as it deepens the understanding of farmer-driven innovation processes in general. These processes are crucial for meeting the severe challenges African agriculture and particularly African small-scale agriculture is facing in the 21st century due to further ecological, economic and political change processes.

Especially due to changing environmental patterns and economic challenges, agricultural innovation is a major element for a further development of agriculture and the improvement of the livelihoods of peasant farmers in Sub-Saharan Africa (e.g. Mazur and Onzere 2006). But for a long time, the focus of agricultural innovation was on the adoption of technologies that were brought to the farmer communities from the outside; research activities as well as the policy agenda revolved largely on the issue of technology transfer, its drivers and constraints. For a considerable period of time, technologies and improved adoption practices developed by the farmers themselves were hardly considered. However, in the 1980s and 1990s a shift from modernization-theory driven 'top down intervention to a grassroots participatory perspective' (Silitoe 1998: 223) happened. The topic indigenous farmers' knowledge, farmers' experimentation or farmer driven innovation processes became more and more part of the focus of the international research community. The advantages of this paradigm shift are according to Reij and Waters-Bayer (2006) obvious. From the science' perspective it is impossible to develop innovation-specific solutions for all of these systems due to the enormous variety of ecological, socio-cultural and economic conditions of each farming system with their very specific characteristics. The

observation of farmer driven agricultural innovation processes in small-scale farming in Sub-Saharan Africa is even more urgent and important on account of the economic globalisation and (global) environmental changes.

Solidarity, ethical values and norms, which are according to Helmstädter (2003:25) part of an institutional human interaction framework and form the basis of knowledge sharing, are in the case of farmer to farmer knowledge sharing of a significant and essential meaning. But as it will be shown in the following, the access to the necessary knowledge is not the only necessary irrigation-relevant resource that is mediated by local reciprocal solidarity bonds and guided by related social norms and values.

V.2 The access to other relevant resources and marketing

This sub-chapter shows that the access to other (non-knowledge related) resources necessary for SGI - namely: land, water and labour - are facilitated via reciprocal solidarity bonds. The access to vegetable marketing (in particular tomato marketing) is an exception in this context although it is of course also another essential basis for dry season farming. As will be shown, the guarantee for having a lasting and reliable access to markets exceeds the capacity the local institutional and social settings as a result of regional and global competition patterns North-Ghanaian dry season farmers have to face. Apart from marketing, production failure may also be caused by internal reasons.

Land and water

Irrigation farmers of course need to own or to get access to a piece of land where shallow groundwater can easily be tapped by a bucket out of a well or with a motor pump out of a riverbed dugout. As land suitable for SGI farming is usually along rivers or floodplains, only part of the farmers own appropriate plots. Within the sample of the 2006 survey for instance, 62 % of the bucket farmers and about 50 % of the pump farmers could actually practice SGI on plots owned by them. Many of the irrigation farmers in the study area therefore have to depend on accessing land owned by others. As already mentioned, land issues in the research area are usually controlled by the *tindanas.*

However, in fact, most of the available land has been distributed to and within the local sections and subsections. The actual piece of land is usually controlled by the (male) family- and household heads. This land is perceived as family property to be bequeathed along the patrilineal lines. There are hardly any options for reclaiming this family land by the local *tindana*. Farmers who do not own any irrigable land must necessarily approach landowners or earth priests to get access to land appropriate for SGI farming. These farmers mainly get their irrigation land from relatives, in-laws, neighbours or friends - mainly within the larger patrilineal kinship clusters of the sections (see table V.4). Within the last years, also a growing number of women (about 20% of the interviewed farmers in the surveys mentioned) started to cultivate tomatoes during the dry season. The women's irrigation plots are rather small and often belong to their husbands' land. The fact that women are in charge of the household and the upbringing of the children, can largely explain why the men among the interviewed farmers in the 2008 survey cultivate 909 m² in mean during the dry season (with a standard deviation of 968) and female farmers only have an average plot size of 540 m² (with a standard deviation of 689).

However, most of the household heads owning irrigable land are willing to share their land during the dry season because they usually do not have the necessary capacities of labour and capital to farm all their land on their own. The land reverts back to the land owner during the rainy season although the irrigation plots are not all being used for cultivation purposes at that time of the year.

Table V.4: Relationship of farmers renting land with respective land users (2006)

Relative by blood	66.3%
In-law	3.6%
Friend	15.7%
Neighbour	4.8%
No relationship	8.4%
Total	100.0%

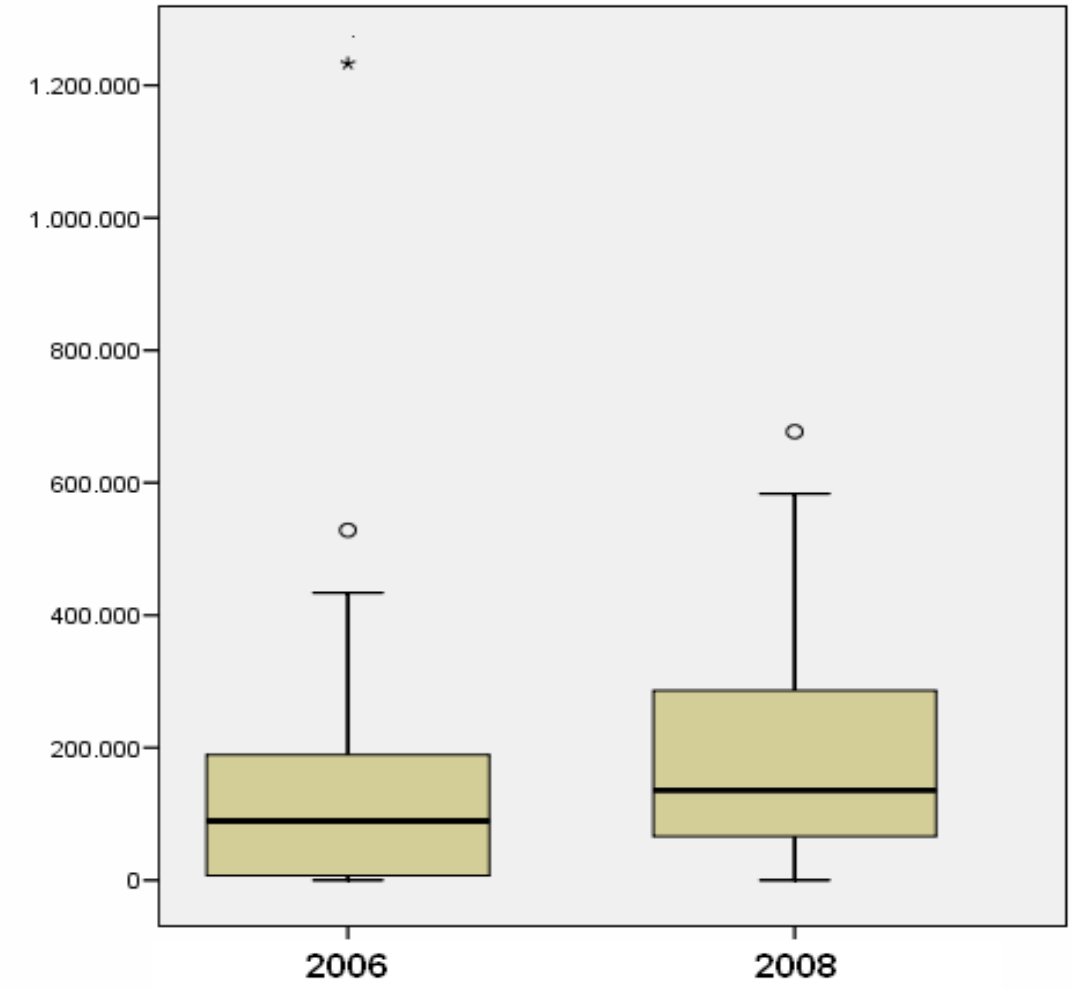
Source: own computation, n=83

It is rather unusual that land is being provided for higher cash payments: only less than 5% of he farmers being interviewed in the 2006 survey obtained their farm land this way. More than 70% of the interviewed farmers even got their land for free, another 25% gave some traditional tokens, such as kola nuts, one or more guinea fowls, a bottle of local gin or a smaller and rather symbolic amounts of money, to the land owner. It is usual that some part of the material or cash payment is paid before the dry season and another part is paid after the harvesting time; oftentimes the payment after the harvest is a smaller proportion of the farm produce, e.g. some small sachets of tomatoes. If the harvest or the marketing situation was bad, most of the landowners do not even require any further payment from their tenants.

However, a recent trend is that farm produces are increasingly being replaced by cash payments (the shelf life of vegetables is too short). Commercial farmers engaged in pump irrigation are frequently asked to pay substantial amounts for land. Although landowners always tend to ascertain that a piece of land cannot be rented according to market-based criteria because it is traditionally inappropriate to ‘cash in’ at fellow farmers’ charge, the trend concerning land rents is contradictory. Figure V.2 shows that the land rents (including the estimated monetary value of the traditional tokens being paid) have significantly increased from 2006 and 2008 two years with comparably good marketing situations. The average growth rate amounts to more than 30%, i.e. from

140.000 Cedis to 186.000 Cedis (the median growth rate is even 45%). A tendency towards higher payments is therefore definitely measurable.

Figure V.2: Land payments (including monetary values of tokens) being paid in 2006 and 2008[34]



Source: own presentation; n=213 each

[34] The value for 2006 was multiplied with the Ghana's inflation rates for 2006 and 2007 in order to guarantee a better base for comparison. Here and in the following, all Cedi amounts are being stated in the old Ghana Cedi, which was substituted by the new Ghana Cedi in July 2007 by the virtual exchange rate of 10,000 to 1, for the reason of a better comparison.

Marketing

Especially the growing demand for fresh tomatoes in Southern Ghana and infrastructural improvements in the Northern part of the country (above all the rehabilitation of the Kumasi-Tamale-Paga road in the mid 1990s) have attracted more and more tomato traders from the South to buy tomatoes in the North. Initially, mainly the large- and medium-scale irrigation projects were the venues for the traders in Northern Ghana. But particularly within the last 10 to 15 years, tomatoes being grown at shallow groundwater farms attracted the traders to an ever increasing degree and vice versa: due to the traders' activities in the area, many farmers were drawn to grow tomatoes via SGI. The traders, the so called 'market ladies' are throughout female and mainly coming from the South-Ghanaian tribes (Ashanti, Ga or Fanti). They have managed to organize their trade in several strong (but informal) associations with strict hierarchies; every market association controls the trade with a certain vegetable like tomato or onion. The market ladies of an association have a common central 'queen mother', who is controlling the whole trade flows. She is also in charge of sanctioning the violation of rules. The queen mothers have excellent contacts and connections to ministries, political parties, customs or other relevant institutions. For that reason, the general societal influence of the market associations and in particular the influence of the queen mothers is very powerful (Laube et al. 2008:12-13, Awo 2007:61).

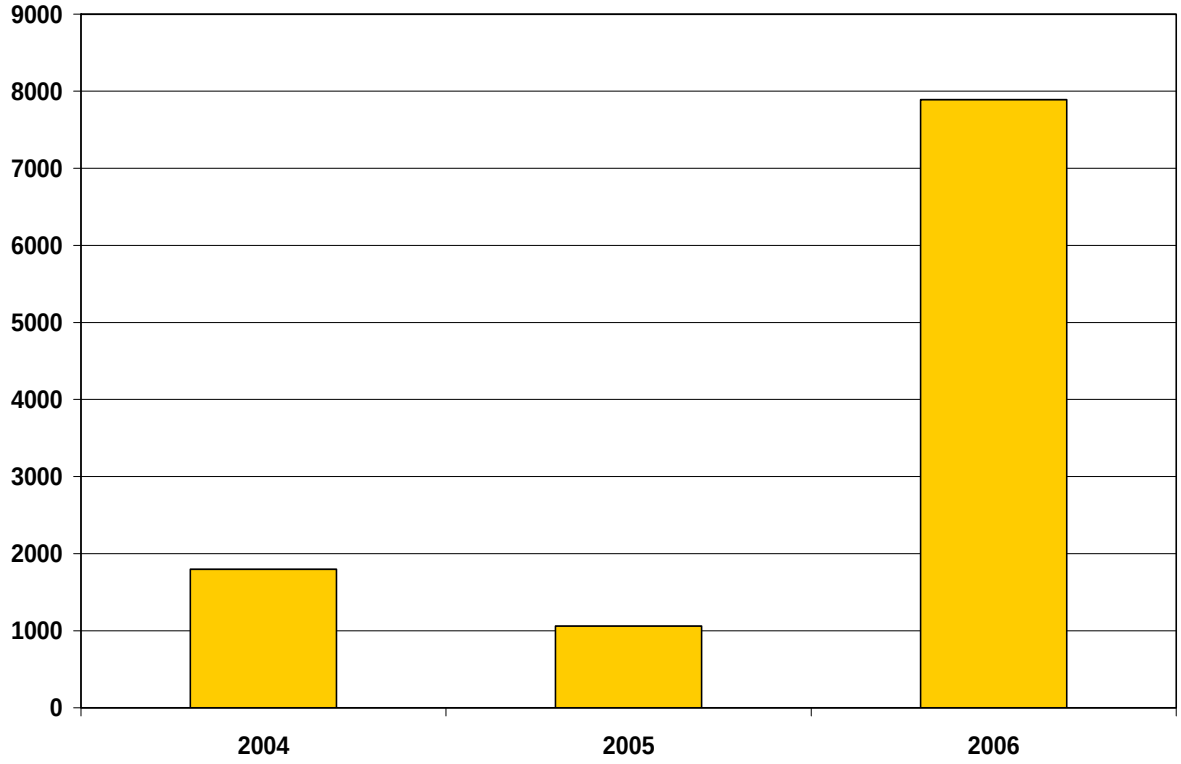
A bargain on tomato prices is not only depending on the farmers and the traders themselves as tomato marketing in Northern Ghana is quite a complex issue. Several, mainly local intermediaries are also very important parts of the tomato trade chain in Northern Ghana. When the traders come with their lorries from South Ghana to the tomato producing areas in the North, they have to hire several local helpers. First of all, they need the help of interpreters because the majority of market ladies is usually not speaking the local languages of the North - and vice versa many of the local farmers hardly speak Twi, the language usually spoken by the tomato traders. The interpreters are usually local agents, who know the farming areas and the farmers and have good language skills in both Twi as well as the local languages. The normal procedure is that an elected representative of a certain farming area has to look for an interpreter, who can send the traders and their lorries to the according farming area. The interpreters are

the intermediaries linking the farmers who want to sell their ripe tomatoes with the tomato traders. Like the market queens, the interpreters, sometimes also called 'lorry leaders', are organized in a strict hierarchical way with an overall local head for all interpreters of a certain area. The interpreters have to give a small contribution to this local head usually being a small amount of their income. This income is paid by the farmers: when the farmers and the traders have agreed on a fixed price per tomato crate after negotiating with the interpreter's assistance, the interpreter in turn gets a fixed amount of this sum per crate. This sum is normally paid by the trader directly. However, besides interpreting the interpreters are in charge of hiring further local persons, who have important functions in the tomato market chain as well. Loading boys are the first to be hired before the lorry arrives at the farm to collect tomatoes. They have to load the lorries with the crates filled with the just harvested tomatoes. Prior to the loading of the crates, the sorting girls, who are also hired by the interpreters, have to sort the tomatoes to make sure that unripe, rotten or half-rotten tomatoes will not come into the crates. In some cases, the sorting girls can keep a certain amount of the sorted out tomatoes for themselves. One of the sorting girls has to take care that the crates with the tomatoes are positioned in a way that they meet the transport capacity of the lorry to Southern Ghana. Both, the sorting girls and the loading boys are directly paid by the tomato traders (Awo 2007:42-48).

Although there are tough negotiations about the tomato prices, in years with positive marketing conditions the relationship between farmers and traders is rather good. Depending on the time of the harvesting season, the prices vary a lot; at the beginning of the harvest time in January, the pricing is normally very flexible while at the peak of the harvesting activities mainly in February, the flood of tomatoes beats down the price dramatically. The prices usually rise again at the end of the harvesting period. Due to their high degree of organization, the market queens are able to influence the pricing by joint agreements; in case they want to reduce the prices, they are paying the farmers for fresh tomatoes; if they want to raise the prices retailers have to pay for the tomatoes in the Southern markets, they will quickly organize a buying boycott. As tomatoes are easily perishable, the farmers are always in a weak position; in the end, they nearly always have to accept lower prices for their produce (Laube et al. 2008:12).

However, not only the power of the traders has made the tomato marketing more risky within the last years. The rising demand for fresh tomatoes in the Southern part of Ghana has encouraged producers in Burkina Faso to grow more tomatoes for the Ghanaian market after their previous major selling market in the Ivory Coast had collapsed as a result of the civil war, which started in 2002. This situation offered the market queens the possibility to buy the Burkinabe tomatoes to an increasing degree because the ECOWAS regulations guarantee the free exchange of goods. As a result, the imports of fresh tomatoes from Burkina Faso to Ghana have dramatically increased within the last years: as figure V.3 shows, Burkinabe tomato imports into Ghana grew by more than 400% between 2004 and 2006 (Awo 2007:29). Quite a lot of rumours came up in connection with the vast attractiveness Burkinabe tomatoes have gained for Ghanaian traders. The most common one, spread by farmers as well as local politicians, says that mainly the opportunity to engage in 'secondary businesses' like the sale of spirituous beverages or fruits as well as the smuggling of arms, gold or drugs makes Ghanaian traders to go to Burkina Faso for buying tomatoes there. Others - not at least the traders themselves - answer that the quality and the comparably lower price of the Burkinabe tomatoes turned the Burkinabe farmers to serious competitors of their neighbouring farmers in Ghana (Laube et al. 2008:12-13).

Figure V.3: Total annual fresh tomato imports in tons from Burkina Faso to Ghana 2004 - 2006

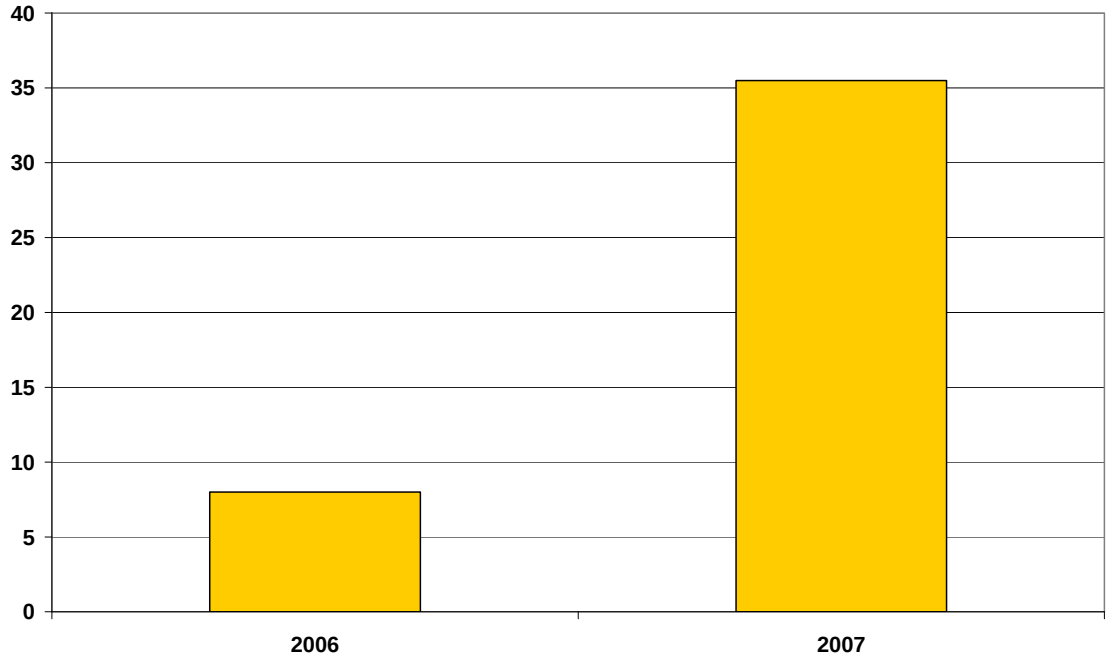


Source: own presentation, based on Awo (2007: 29)

However, in early 2007 the market situation caused by the competition with tomato producers of Burkina Faso sharpened dramatically for the North-Ghanaian tomato farmers. The Ghanaian market queens totally ignored the tomato farmers in the Upper East Region almost during the whole harvesting time and passed by directly to Burkinabe tomato farms. For that reason, the tomatoes of the Ghanaian irrigation farmers widely rotted on the farms. Some of the farmers reacted with blocking the roads for tomato lorries returning from Burkina Faso and even attacking the traders and their hired personnel. These actions and a couple of media reports concerning tomato farmers who have committed suicide on account of their desperate situation after the harvest (e.g. Ghana Today 2007) gained nation-wide attention in Ghana and obviously pressurized the Ghanaian government to take action. With the published official reason that Burkinabe tomato producers would illegally use hazardous substances in the cultivation process, the Ghanaian government blocked the border to Burkina Faso for

two weeks. As the market queens were forced to buy Ghanaian tomatoes, they slowly did out of pure necessity (Laube et al. 2008:13).

Figure V.4: Percent of interviewed farmers that made a loss in 2006 and 2007



Source: own presentation; n for 2006=213, n for 2007=62

But this solution came very late: many farmers at that time were unable to sell anything because all their tomatoes got spoilt before. As a result, about one third of the interviewed farmers made a (severe) loss in the end - in the previous year there were only 8.5% of the farmers being interviewed that could not cover their expenses (see figure V.4). Accordingly, the average profit of the interviewed tomato farmers drastically went down from more than 2.200.000 Cedis in 2006 to barely 920.000 Cedis the following year.

Also the second market channel - the market for processed tomatoes - could not be of an essential help to the North Ghanaian tomato farmers in this situation. Until the mid 1980s, the tomato processing industry in Ghana was based on the three state-run canning factories in Wenchi (Brong Ahafo Region), Nsawam (Greater Accra Region) and Pwalugu (Upper East Region). As a result of the severe debt crisis in the early

1980s, the Ghanaian government had to adopt an IMF- and World Bank-driven policy of deregulation, opening of markets and privatization (see chapter IV.2). The opening of Ghana's market for the import of cheap, subsidized tomato paste, especially from Europe but also from China or (South-)American countries, led to the collapse of the three Ghanaian canning factories in the course of the 1980s and early 1990s (Khor 2006:33), which for a long time had anyway been suffering from technical difficulties (Konings 1981:51). In the following, the imports of tomato paste increased dramatically: the imports from Europe alone enlarged from 3,713 tons in 1993 to 27,015 tons ten years later in 2003 - corresponding to a rise of more than 600 percent (ISODEC 2004:9).

In response to the public pressure to create new market channels for processed tomatoes besides small-scale processing, the Ghanaian government announced that the Pwalugu tomato factory, meanwhile quite run down (see Photo V.2), would restart the processing of tomatoes in the dry season of 2006/2007 and farmers were accordingly encouraged to produce tomatoes. For the reactivation of the factory, the government of Ghana started negotiations with 'Trusty Foods ltd.', an Italian company belonging to the Rosa family, the largest tomato producer in Italy. The company agreed to run the factory, which is officially still owned by the Ghanaian government, under the new name 'Northern Star Tomato Factory'. Trusty food started with the import of processing machineries and sent two technicians from Italy. Officially, the factory should run at full capacity in three shifts to process about 500 tons of tomato into paste per day. A test run was initiated in December 2006. In the following months, severe problems in the field of management and infra-structure emerged. For instance, there was a great lack in the adequate supply with crates for the tomatoes to be bought thereby massively limiting the buying opportunities of the factory. On the other hand, the test-run had to be supplied with expensive energy produced by a generator because in early 2007 the factory was not connected to the national electricity grid of Ghana. However, even this would not have been a real relief as Ghana had to face a severe energy crisis in that time.

Photo V.2: Entrance to the tomato canning factory in Pwalugu

Source: own photo

On account of the low-level production, less than 4% of the irrigation farmers being interviewed in the survey of 2007 - who had been encouraged by local politicians to produce tomatoes for the factory - could sell at least a small amount of their tomatoes to the Pwalugu tomato factory. Also in the years 2008 and 2009, the buying and processing capacities of the factory remained very low. Therefore it is quite obvious that the reopening of the factory did so far not prove to be a relief for the North-Ghanaian tomato farmers in terms of marketing.

Labour

As already discussed earlier, an economic behaviour related comparison of peasant households with a commercial company is not really adequate due to the direct link between production and consumption in peasant households. Put simply: when an entrepreneur makes a wrong decision, this may end up in a loss for his company; however, when a peasant takes a wrong decision he and his family may painfully feel that in their empty stomachs. The unity of production and consumption determines certain patterns of decision making that gives peasant households to some degree a unique position in otherwise throughout capitalistic systems (Scott 1976; Wolf 1966). This circumstance induces important implications for the crucial production factor of labour.

In the classical household model of Chayanov (1966), which essentially influenced several other farm household models (e.g. Barnum and Squire 1979), the production-consumption nexus is determined by the demographic composition of a peasant household. In particular, Chayanov's model indicates that the output of a farm household is determined by a function of the opposing factors concerning the subjective utility of the farm output to meet the consumption requirements of the household on the one hand and the disutility of hard work that has to be done on the other hand. The trade-off between the avoidance of work and the earning of a sufficient income is highly affected by the household ratio between workers, meaning people with the physical and psychological condition to contribute to the household production (predominantly healthy adults and adolescents below a certain age), and consumers, i.e. mainly smaller children and elderly or decrepit people. The major implication of this household model is that the availability of labour and in consequence the cultivation opportunities are highly dependent on this ratio. Furthermore, the Chayanovian perception of the farm household entails that the cultivation opportunities are directly determined by a demographic cycle. For instance, a peasant couple with smaller children is significantly limited in his labour force availability and as a result in its cultivation choices due to the fact that their children are not able to help on the farm yet. This constraint will not decrease until one or more children are old enough to contribute to the farm labour input.

Chayanov's model is based on the assumption of completely lacking or failing labour markets. In the past, many studies on peasant agriculture in Sub-Saharan Africa were dominated by the assumption of a relative absence of any kind of labour market (Binswanger et al. 1989). But this perception has changed fundamentally as the research scope was widened by studies like the ones by Kevane (1994) or White (2002). These studies show that also agricultural wage labour markets in rural Sub-Saharan Africa certainly do exist; labour markets however are still widely based on traditional and non-market economy related forms of labour exchange and the hiring of labour. The forms of payment are rather of symbolic nature (e.g. in form of drinks or food provided by the 'employer') while the ability to arrange labour supply that way is partly considered to be socially prestigious. It was therefore shown that they are definitely alternative ways besides market-based models to hire additional labour in order to overcome alleged labour force constraints induced by the demographic composition of a farm household.

The farmers in the study areas use predominantly traditional forms of hiring labour and labour exchange. Especially labour exchange is partly based on the local informal farmer associations or smaller groups. A labour exchange group may also be founded spontaneously. Those groups may travel from the different members' plot to plot to fulfil certain labour tasks. But more common is the hiring of labour (see table V.5). One or more persons from the neighbourhood and/ or the extended family are hired; the local symbolic payments usually range from some kola nuts, a bottle of liquor, a guinea fowl or a small amount of money. A clear distinction between 'hired' and 'exchanged' is not easy to be made because sometimes within exchange labour groups, small payments are usual. For that reason, these two forms are mainly used simultaneously in the following. Table V.5 shows the typical shallow groundwater related labour tasks from land clearing to harvesting and the specific share of farmers who utilize hired and exchange labour. In particular labour-intensive tasks, such as the (re-) digging of the irrigation wells and dugouts, the making of ridges, land clearing or weeding, widely use hired and exchanged labour. For rather day-to-day tasks, such as watering or fertilizer application, these forms of labour supply are hardly utilized.

Table V.5: Average usage of exchanged and hired labour for SGI related labour tasks (2008)

	Exchange labour	Hired labour
Land clearing	10.8%	11.3%
Digging of Wells/ dugouts	35.2%	42.3%
Re-digging	18.8%	25.4%
Making of nurseries	2.8%	5.6%
Making of ridges	15.5%	19.2%
Transplanting	5.6%	12.2%
Watering	1.4%	2.8%
Fertilizer application	1.4%	2.3%
Weeding	4.2%	10.3%
Spraying of herbicides, pesticides, etc.	0.0%	28.6%
Staking	1.4%	7.5%
Harvesting	4.7%	21.6%
Refilling of wells/ dugouts	0.9%	9.9%

Source: own presentation; n=213

Table V.6 shows the average utilization of hired or exchanged labour for the male and the female irrigation farmers, for the dependency ratio groups (low and high) of their households and for the irrigation form they are practicing. An indicator for the degree of usage of these labour supply schemes was generated by summing up the number of times a farmer has used hired or exchanged labour for a certain task. The table shows that particularly farm households with a high dependency ratio draw on patterns of labour exchange and hired labour. Obviously, they have found an adequate way to overcome their demographically induced structural disadvantages concerning labour supply. Also the pump irrigation farmers use more extensively the traditional forms of generating additional labour force as their plots are on average more than three times

bigger than those of the bucket farmers. According to the findings of the 2008 survey, the least have a mean plot size of 600 m² (with a standard deviation of 638) whereas the farmers who irrigate their fields with pumps have a mean plot size of 1,922 m² (with a standard deviation of 1,218). Female farmers use slightly less hired labour or labour exchange than their male peer farmers. Apparently, it refers to a higher average plot size of male farmers. This fact does not mean that female farmers are rather excluded from the traditional labour supply patterns, but it is related to the circumstance that male farmers usually farm more land than female farmers (see previous sub-chapter) and female farmers are often supported by their husbands' labour force.

Table V.6: Mean values for hired/exchanged labour-indicator by dependency ratio and irrigation kind practied (2008)

		Hired/exchanged labour-indicator	
		Mean	Standard deviation
Sex*	Male	3.13	2.37
	Female	2.31	1.93
Dependency ratio**	Low[35]	2.83	2.32
	High	3.59	2.34
Irrigation kind practiced***	Bucket	2.73	2.19
	Pump	4.19	2.60

Source: own presentation; n=213

* The p-value for the correlation between the variable 'sex' and 'hired/exchanged labour-indicator' is 0.91

** The p-value for the correlation between the variable 'dependency ratio' (the metric version of the variable was used for the correlation) and 'hired/exchanged labour-indicator' is 0.10

*** The p-value for the correlation between the variable 'irrigation kind practiced' and 'hired/exchanged labour-indicator' is 0.00

[35] The dependency ratio of the households was calculated as follows: number of household members under 13 years of age + number of household members who are 65 years and older divided by the remaining number of household members. Low dependency ration is here defined with a value of 100 or less. All values with the size of more than 100 are defined as a high dependency ratio.

Table V.7: Mean amounts of payment for labour by gender, dependency ratio and irrigation kind practiced (2008)

		Payment for hired/exchange labour in Cedi	
		Mean	Standard deviation
Sex of irrigation farmer*	Female	108,462	147,429
	Male	293,244	599,008
Dependency ratio**	Low	246,261	527,867
	High	320,411	661,969
Irrigation kind practiced***	Bucket	124,859	260,336
	Pump	859,821	963,590

Source: own presentation; n=213

* The p-value for the correlation between the variable 'sex' and 'payment for hired/exchanged labour in Cedi' is 0.12

** The p-value for the correlation between the variable 'dependency ratio' and 'payment for hired/exchanged labour in Cedi' is 0.40

*** The p-value for the correlation between the variable 'irrigation kind practiced' and 'payment for hired/exchanged labour in Cedi' is 0.00

Table V.7 shows the average amounts of money spent for hiring additional labour per categories, sex of farmer, dependency ratio and irrigation kind. The estimated prices for symbolic payments like liquor or cola nuts were integrated into the specific payment amounts. The average sums paid by male and female farmers as well as by farmers with a low and a high household dependency ratio differ to a low extent. The differences correspond with the respective degree to which hired/ exchange labour was utilized within the defined groups, but are also related to differences in average land sizes. However, this does not apply to the average payment levels of bucket and irrigation farmers. The pump farmers have an almost seven times higher mean amount than the bucket farmers although the degree of usage differs apparently to a much lower extent. The farmers irrigating their fields with pumps have to pay significantly more money for hired labour than the bucket irrigators because to an increasing degree they have to hire farm labourers, the so called farm boys. According to the farmers' statements, the plots

of the pump farmers grew further and further with increasing profits to the same extent as the amount of labour associated with it. However, at the same time, the related labour efforts could not be met by means of the traditional labour exchange/ hired labour system any longer. Accordingly, the rising demand for labourers to work permanently on the big pump irrigation farms during the dry season - and more and more also on big bucket farms - has created a small rural micro labour market in the shallow groundwater areas. The non-market economy-based organization of labour supply is ever more unable to suffice the needs of the labour sector as a result of the ongoing professionalizing and commercialisation of pump farming

Generally, due to their specific degree of physical efforts, the irrigation related labour tasks are very gender-specific. Tasks like transplanting or the picking of the fruits are largely being done by women or girls; labour-intensive work steps, such as the digging of the wells or dugouts, is male work. Other tasks like watering are conducted by both genders (see photo V.3).

Photo V.3: Women taking irrigation water from a well

Source: Wolfram Laube

V.3 Limitations and constraints of growth

Besides marketing, there are several other reasons, which limit and constrain shallow groundwater as an adaptive livelihood strategy. Table V.8 shows the mean irrigation experience in years within the Anayare catchment communities of Doba and Teleania and the Atankwidi catchment communities whereas all sub-samples in the communities having generally similar heterogeneous age distributions. The highest average experience can be found in the originating places of the small-scale irrigation development in Telania. The other values correlate largely with the sequence of spreading of SGI among the two river catchments (see chapter V.1). Furthermore, the table shows that the development up to now has not reached the very Northern communities of Sirigu and Yuwa, none of the interviewed households has so far applied dry season irrigation farming.

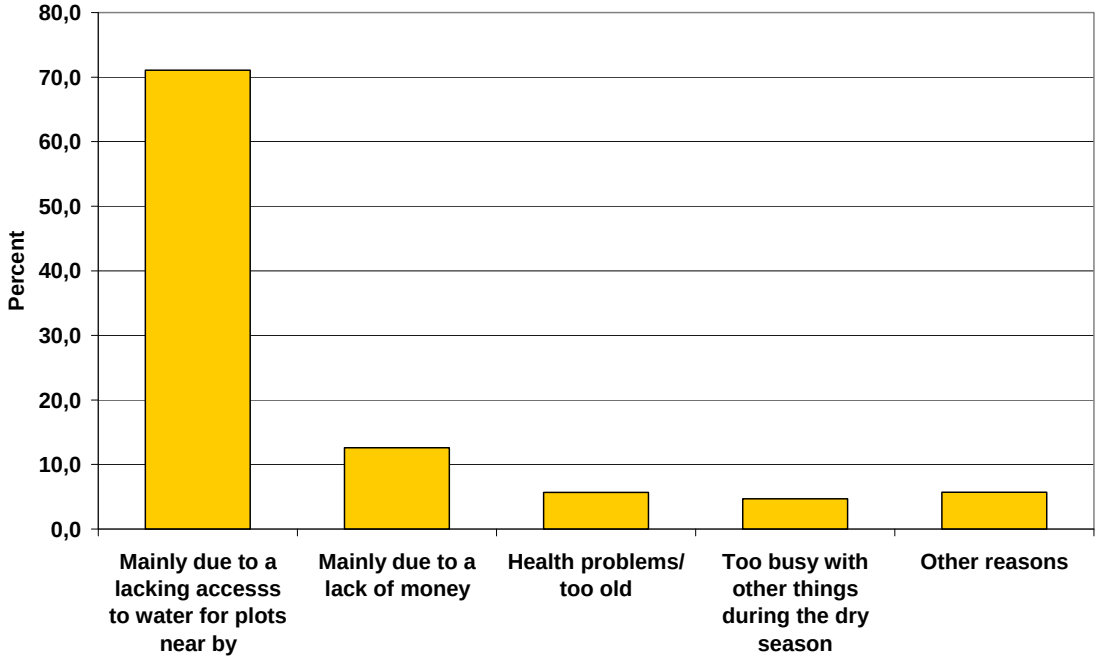
Table V.8: Average irrigation experience of active irrigation farmers by communities (2007)

Communities	Mean	Std. Deviation
Doba	15.1	18.8
Kandiga	6.0	3.6
Sirigu	.	.
Sumbrungu	6.1	3.4
Telania	22.3	8.7
Yuwa	.	.
Zokko	3.5	0.7

Source: own computation; n=86

The question is: why did SGI not reach those areas? Figure V.5 shows that more than 70% of the farmers who are not into irrigation farming state that they are not adapting SGI as they do not have access to plots with adequate water resources nearby although they would highly be interested in SGI. These statements were predominantly made in Yuwa, Sirigu and also Zokko, where only 3 out of 36 interviewed farmers are practicing dry season farming. In interviews prior to the survey, many farmers in these areas stated that on account of the very bad hydrological conditions in their region shallow groundwater based farming was not possible. In the North-Western part of the Atankwidi catchment, the groundwater table is much too deep throughout most of the time in the dry season to dig sufficient dugouts in the riverbeds or solid wells at the riverine plots. At some places in the Northern part of the catchment, several farmers who had observed the development of irrigation farming in the Southern part of the catchment started to irrigate plots during the dry season as well. They experienced that they were running out of water very soon as the physical limits concerning the deepness of a hand-dug well or dugout were reached shortly after they started to irrigate. The farmers confirm that irrigation-related wells have a limit of approximately 7 to 8 meters.

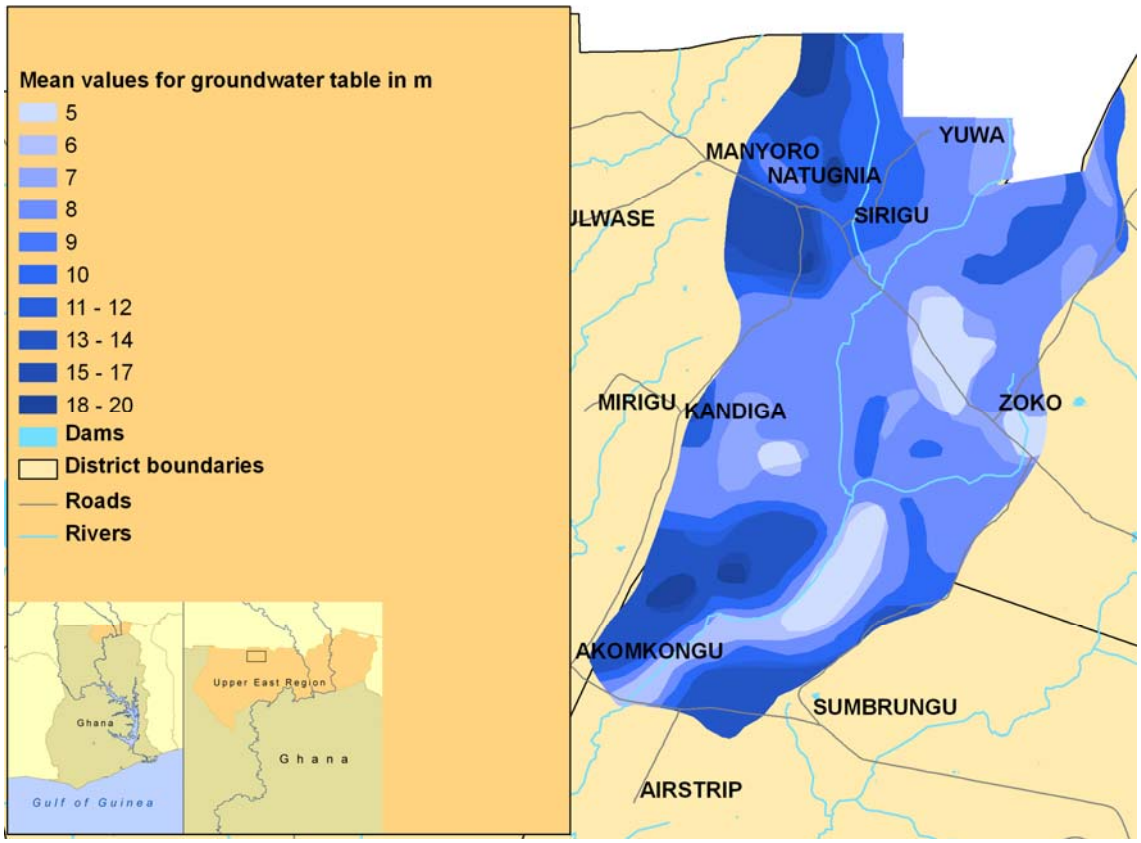
Figure V.5: Main reasons for not doing irrigation farming (2007)



Source: own presentation, n=150 (Atankwidi data)

To cross-check the farmers' statements with hydrological information gathered within the scope of the GLOWA Volta Project, a groundwater table indicator map of the Atankwidi catchment was generated. The values of this indicator map of the groundwater table in the Atankwidi catchment were calculated by taking data measurements by Martin (2006). They are particularly based on mean values of groundwater measurements within the catchment area at the end of the dry season in April 2002/2003 and at the beginning of the dry season 2003/2004 in October 2003.

Map V.1: Indicator values for the differences in the groundwater table throughout the Atankwidi catchment during the dry season



Source: own computation, based on Martin (2006)

Map V.1 shows that the groundwater table values along the Atanwikdi river in the South of the catchment area close to Sumbrungu are favourable for irrigation farming due to the low groundwater table whereas the middle part around Kandiga has moderate groundwater table values. Very deep groundwater table values can be found in the area of Sirigu and the Western part of Yuwa. The hydrological measurements support the farmers' experience. In the North-Western part of the Atankwidi area, the hydrological conditions do not favour SGI as it is practiced widely in other parts of the study region. In the North-Eastern part of the catchment from Eastern Yuwa down to Zokko, the hydrological situation is not that bad.

Photo V.4: Typical rock formation close to Yuwa

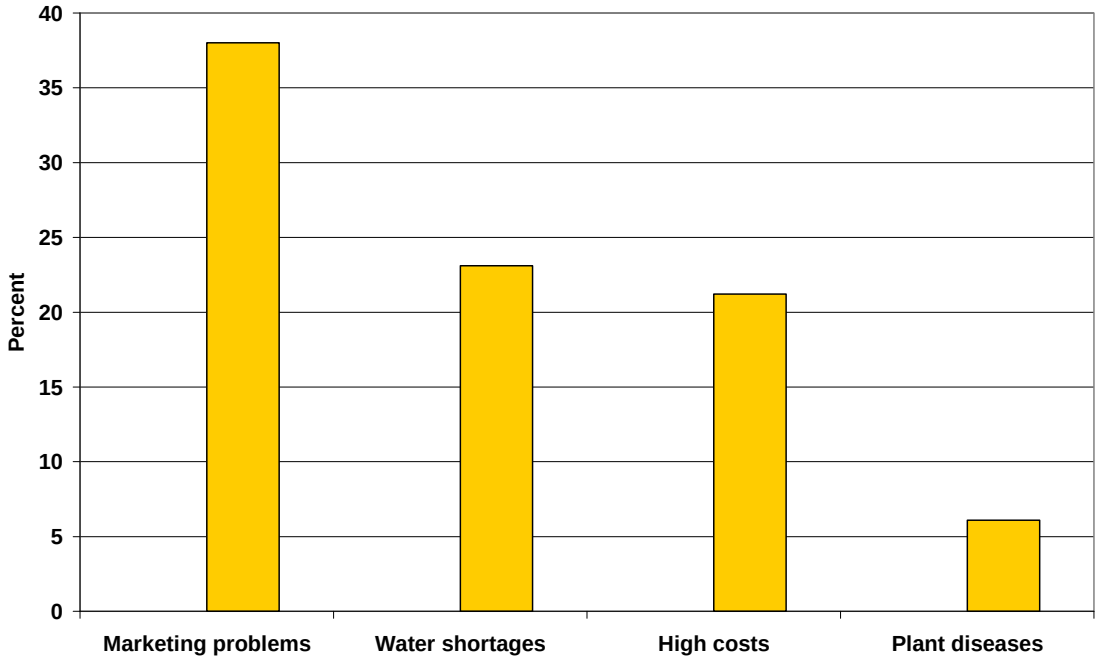
Source: own photo

Within this area the limiting factor is rather of geological nature and not connected with the groundwater table. The surroundings of Yuwa and Zokko are interspersed with dense rock formations, even below the surface (see Photo V.4), thereby hindering SGI. According to interviews with farmers in this area, usually impenetrable rocks prevent the digging of riverbed dugouts or riverine wells so that the groundwater table cannot be reached.

Besides certain geological and hydrological conditions, also other factors like soil quality, elevation levels and the maximum distance of plots from the riverbed hamper the future growth of SGI farming. Taken into consideration all these factors, Schindler (2009:168) comes to the result that the maximum area to be cultivated by this irrigation form is 291 ha in the Atankwidi catchment. Provided that this value is correct, the

maximal irrigable area is cultivated meanwhile. The potential for further farmers to do dry season irrigation farming in this area therefore is very limited.

Figure V.6: Major problems of irrigation farming as faced by the farmers (2006)



Source: own presentation; n=213

Also in the areas where SGI has been practiced for years or even decades farmers are partly meeting severe constraints and problems apart from the sometimes very difficult market access. As figure V.6 shows, the most serious problems tomato farmers are facing besides marketing issues are water shortages, high costs and plant diseases.

Table V.9: The last time farmers have lost crops due to water shortages (2006)

10-6 years ago	1.4%
5-1 year ago	20.2%
This year (2006)	37.1%
Never have lost crops due to water shortages	41.3%

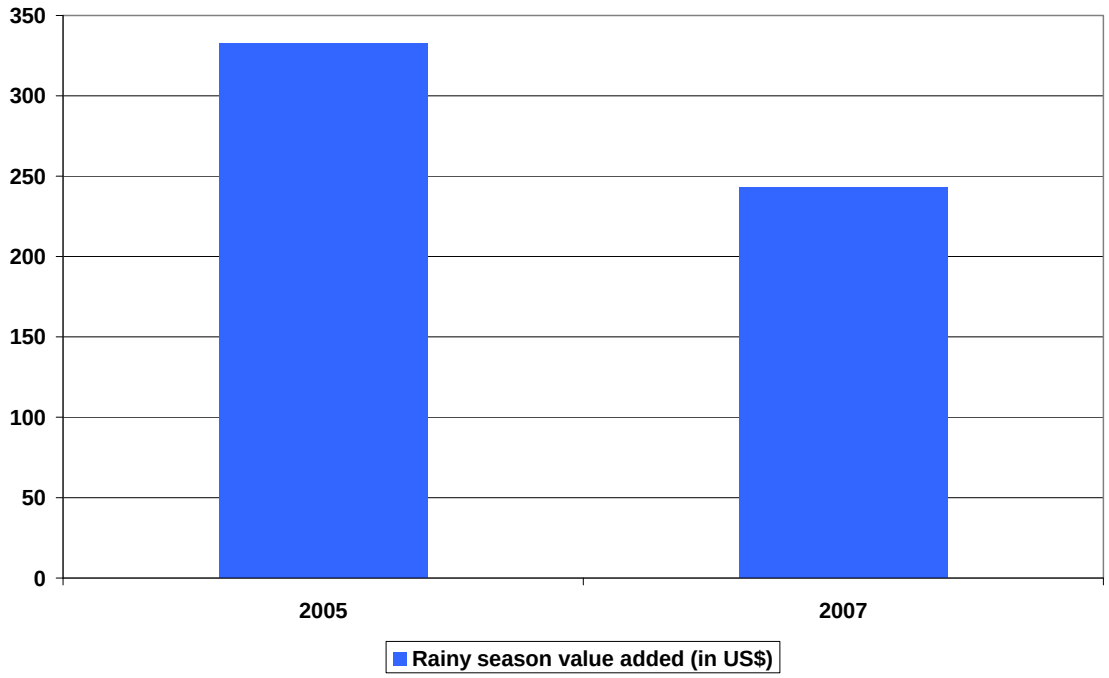
Source: own presentation, n=213

According to table V.9, almost 60% of the farmers interviewed in 2006 were confronted with the problem of water shortages in the past. It also shows that the loss of crops due to water shortages peaked in 2006 as a result of a couple of years with rather poor rainfalls. Consequently, the overall groundwater table levels in the whole catchment area were affected. Many farmers in an otherwise farming area with hydrological favourable conditions had to dig very deep before they could access groundwater. The situation improved after the floods in late 2007. The groundwater table increased dramatically so that the problem of water shortages in the following dry season did only appear to a minor degree. Although the hydrological research on the interrelations between groundwater levels and SGI is still in progress, there is no doubt that the possibilities of this irrigation form are highly dependent on the preceding rainfall patterns and undisturbed groundwater percolation. The adaptive capacity of dry season irrigation farming is therefore up to a sensitive and adapted utilization of the resource water (Laube et al. 2008).

Crop diseases are also affecting dry season irrigation farming negatively. As there are no agricultural extension services in their farming areas, shallow groundwater farmers have to rely on trial and error approaches to find ways and means to treat plant diseases. Even for the irrigation project farmers in the region, extension services are hardly available and related professional knowledge is therefore quite low. In the dry season 2003/2004, a tomato infection affected hundreds of hectares of shallow groundwater as well as project side tomato farms in the Upper East Region. The disease destroyed the plants that just started fruiting and caused a big loss for thousands of farmers (News in Ghana 2004; Laube et al. 2008:12).

The missing professional support will most-likely influence the future situation of the farmers in the study area. Farmers argue that on account of the irrigation boom in recent years, the soil quality in the shallow groundwater irrigated plots is decreasing. SGI farmers are in need of professional support because their capacities and abilities to acquire and disseminate knowledge to cope with such developments are rather limited.

Figure V.7: Mean rainy season value added in US$[36] - 2005 and 2007 in comparison



Source: own presentation, n=213(each)

There are direct links between the dry season farming outcomes and the rainy season farm performance of SGI farmers via a partial reinvestment of SGI income in rainy season farming (see also Table V.10). These investments could additionally lead to more food security. If, however, SGI income breaks away, it may result in much lower rainy season crop yields. There is evidence that the devastating market situation of 2007 - besides the floods affecting parts of the study area in September 2007 - had at least contributed to lower rainy season outcomes. Based on market price inquiries and the

[36] The mean rainy season value added was multiplied with the official dollar exchange rates of reference dates for the respective seasons (01.10.2005 and 01.10.2007).

SGI surveys of 2006 and 2008, average rainy values added[37] were constructed to use these values as estimators for the agricultural performances of irrigation farmers in the respective seasons. Figure V.7 shows that there was a strong decline in the average values added from US $ 332 in 2005 to US$ 243 in 2007, which is a decrease by 27%.

V.4 Shallow groundwater irrigation farming and its adaptive effects

Despite the problems and constraints connected with SGI, the high adoption rate throughout the second half of the 1990s and the early 2000s (see chapter V.1) points up its positive adaptive effects. According to the farmers' statements, the major benefit of irrigation farming is that it generates a (higher) cash income that predominantly can be invested into a higher level of food security. As table V.10 indicates, about 84% of the interviewed irrigation farmers spend their income deriving from dry season farming for household expenditures, i.e. mainly to buy food. The table furthermore shows that dry season farming has enabled some households to spend more money for educational and health purposes. Mainly the female farmers use their irrigation income for these issues as they are traditionally responsible for the upbringing and well-being of the children (and other household members). Generally, livestock as 'living' capital reserve (see chapter II.3) is also often purchased with SGI income.

[37] For the estimation of the rainy season values added, the specific harvested amounts of early millet, late millet, early guinea corn, late guinea corn, rice, groundnuts, bambara beans, soy beans and pepper were multiplied with the average seasonal market prices (in Cedi) per season for each of the plants. See Appendix 4 for the exact plant weight factors.

Table V.10: Main purposes the irrigation farming income is spent for (2007)

Household expenditure	83.6%
Education	34.4%
Livestock	26.2%
Health issues	21.3%
Farm inputs	11.5%
Other	8.2%

Source: own presentation; n=61 (Atankwidi data)

To numerically measure the differences concerning the standard of living irrigation and non-irrigation households have, a wealth indicator was generated. The indicator is based on the quantity of household-owned assets, such as radios, pumps, bicycles or TVs as well as on the quantity of the owned livestock. Every item was multiplied by the quantity owned by the specific household and then weighted by the approximate market prices of the specific item based on Navrongo market data inquiries in 2006. This wealth indicator was also applied to the surveys of the years 2007 and 2008 using the same weighting on the condition that the price relation between the specific items has not changed.

In table V.11, the differences concerning standard of living between irrigation and non-irrigation households are according to their specific wealth indicator values significantly high. The mean value for the households practicing SGI is almost twice as high as the one for the non-irrigation households although the standard deviation for the irrigation household related value is quite high.

As they do not have a dry season farm income, non-irrigation households have to rely slightly more on off-farm income. According to careful estimations on their monthly income deriving from non-agricultural source, non-irrigation households had an average amount of 256,000 Cedis a month while irrigation households had a mean value of 202,000 Cedis. The interesting difference concerning the specific off-farm income situation of irrigation and non-irrigation households is that the first mentioned are much

more involved in trade activities. More than 60% of the irrigation households are trading goods and less than 40% of the non-irrigation households are engaged in trading activities, which are usually associated with high investment costs. Households without dry season irrigation farming still have to rely on labour-intensive non-farm activities, such as food processing or crafts.

Table V.11: Descriptive statistics regarding the wealth indicator by irrigation and non-irrigation households (2007)

				Statistic	Standard Error
Wealth indicator	Non-irrigation households	Mean		24.89	2.82
		95% Confidence Interval for Mean	Lower Bound	19.28	
			Upper Bound	30.50	
		Median		14.50	
		Std. Deviation		26.64	
	Irrigation households	Mean		46.01	6.21
		95% Confidence Interval for Mean	Lower Bound	33.59	
			Upper Bound	58.43	
		Median		26.50	
		Std. Deviation		48.49	

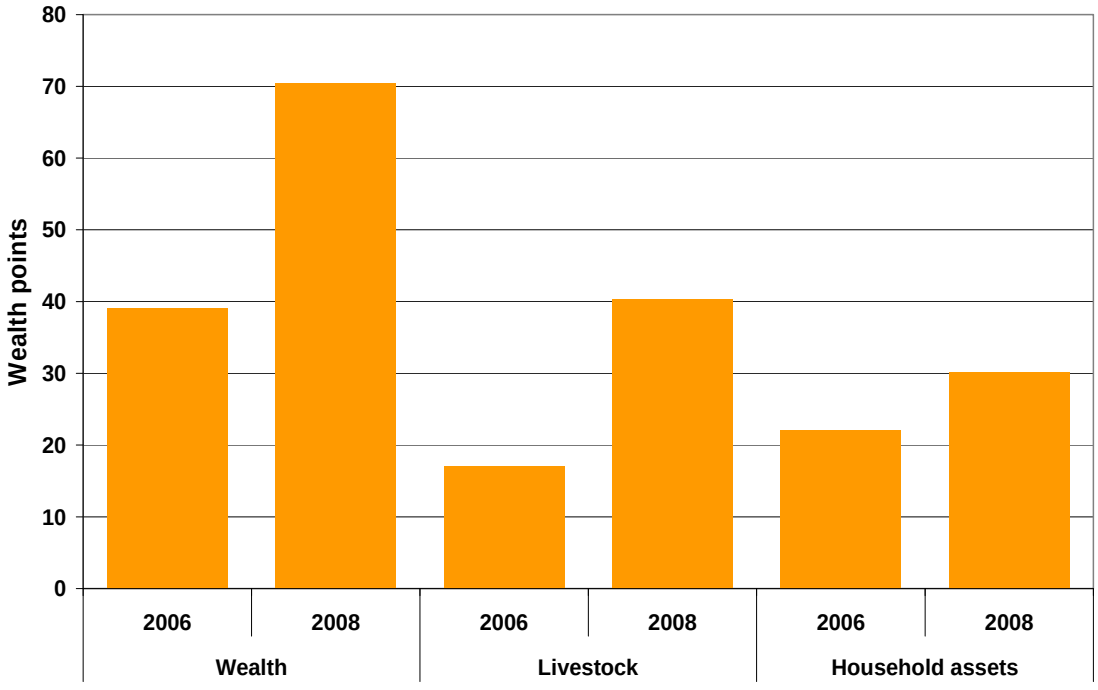
Source: own presentation; n=150 (Atankwidi data)

The Pearson correlation coefficient of the correlation between the variable 'irrigation' and 'wealth indicator' has a p-value of 0.00

The comparison of the wealth indicator values for 2006 and 2008 shows that - despite the marketing failure of 2007 (see the IV.2 - subchapter on marketing) - the values have increased. Not only the overall mean indicator value for the standard of living has grown by more than 80% on average, also the mean indicator values for livestock and

household assets have clearly increased significantly from 2006 to 2008 (see figure V.8). The extremely strong increase as regards the livestock score (more than 130%), which is largely causing the overall wealth score increase, can be explained with the circumstance that the survey in 2008 was conducted later (May) than the one in 2006 (March). Therefore, the farmers' income was already paid out completely and - based on personal interviews - more heavily invested in livestock than two years ago. Among other reasons, this behaviour can presumably attributed to the shocking marketing failure experience of 2007, so that the need to invest into security deposits has been raised.

Figure V.8: Mean wealth indicator points - 2006 and 2008 in comparison



Source: own presentation, n=213(each)

The result indicates that the adaptive capacities generated by SGI are apparently strong enough to guarantee economic growth accompanied by poverty reduction, which can also contribute to mitigate the vulnerability of households. Furthermore, these adaptive capacities enable the farm households to cope with disastrous short-term events, such as the market crisis of 2007.

Chapter summary

SGI is quite successful as an adaptive strategy in the research area as it largely enables the farm households' to improve their living standard situation. Therefore, it is a powerful tool to counteract environmental as well as economic stressors, in particular in the field of food security. The spreading of SGI was and is mainly pushed by the non-market-economy based supply of knowledge, land and labour within kinship groups as traditional bases for reciprocal solidarity. However, there are also a couple of risks and constraints associated with SGI; due to regional and global competition as well as the tough organization of traders, marketing failure is a situation small-scale tomato growers in Northern Ghana may ever face. Furthermore, also plant diseases, soil erosion or water shortages remain production risks threatening farmers. Moreover, the spreading of small-scale irrigation is - at least as it is described here -spatially limited due to hydrological or geographical conditions in wide parts of the study area.

VI The significance of seasonal migration

The following chapter will deal with the question of how significant (seasonal) migration is for households which are into SGI in the dry season and households which are not. Furthermore, it shall be analyzed how important the cultural meaning of seasonal migration is in the study region.

VI.1 Migration decision theories - from laws to cultures of migration

Migration and in particular the question 'why do people move from one place to another' have been in the focus of socio-economic research for more than one century. This sub-chapter wants to provide a basic overview on the trends and major theoretical assumptions being made during the long history of research on migration and migration decision making.

The beginning of migration theories and research on underlying decision making processes can be dated back to the 1880s when Ravenstein (1889) published two articles in the 'Journal of The Royal Statistical Society' about the so-called 'Laws of Migration'. In these articles, Ravenstein primarily explained the phenomenon 'migration' with the natural disposition of human beings to improve their material living conditions. Consequently, the existence of places with different levels of development and different wage levels causes the migration of what he called 'surplus population' from the places with low salary levels to places with higher salary levels. Ravenstein also introduced an element of migration research, which is still very significant in contemporary migration research, namely the idea of 'push' and 'pull' factors. Push factors can be certain economic, political, social, violent or environmental or ecological circumstances at the place of origin (e.g. civil wars, natural disasters, low salary levels) putting pressure on people to migrate whereas pull factors are incentives at a possible place of reception like higher salary levels (Lee 1966:49-52).

In the first half of the 20th century, the research on migration was mainly driven by geographers who developed models that could explain migration phenomena with the

help of certain gravitation laws. Ravenstein already suggested that for migrants there is a strong relationship between the distances from the place of origin to the (possible) place of reception. The farther a possible place of reception is away, the lower will be the number of migrants to go to that place mainly due to the higher transport costs. Authors like Zipf (1946) or Stewart (1960) based their research on Newton's gravity laws and adjusted it to the circumstances of demographic movements. The concept of analysing macro-structural components was also the major element of the famous Harris-Todaro Model (Harris and Todaro 1970). The main assumption of this model is that the migration between the rural and the urban sector is taking place when urban income levels are higher than rural income.

In the 1960s, the research on migration determinants also moved away from a macro-level to more individualistic perspectives. Factors like migration costs were taken much stronger into consideration. In the field of economic research (particularly due to the upcoming human capital approach), migration was increasingly also perceived as an individual investment in human capital. Accordingly, in this approach formulated and further developed by Sjaastad (1962), Becker (1964), Mincer (1974) and others, the migration decision is a process that is determined by several factors. They comprise unequal salary levels as well as the employment probability at the place of reception and costs connected with the migration process. Those factors depend on individual characteristics like age, gender or the personal readiness to assume a risk. According to Engel and Ibanez (2007:339), this approach implies different hypotheses: the migration probability rises with the level of education as potential migrants with higher educational levels will generate more income (especially in urban areas); the migration probability also depends on the individual level of risk-aversion. Furthermore, personal contacts in a potential receiving area reduce the costs of migration and information purchase, what accordingly increases the probability of migration. Lastly, age is also an important factor since the individual life planning horizon is also seen as an important factor influencing the migration decision, what means that the older a potential migrant is, the more unlikely is that he or she will migrate.

Since the 1980s, the economic research on migration looked at the information costs associated to a migration decision. Fischer et al. (1997:62-69) conclude that there is a positive correlation between the distance to a place of reception and the information

costs, meaning: the farther the distance, the higher the costs. Migrants will most-likely go to those places they have more information about or the relevant information costs are relatively low. This depends on the quality of the information they receive: the more positive the information about a receptor place is, the more likely is the migration to this place.

However, the so called New Economics of Labour Migration (NELM) coming up in the 1980s and 1990s (e.g. Stark 1991) partly revise the neoclassical assumption of purely individualistic determinants of the migration decision and focuses on the household as arena of migration decision making. The central point of this approach is that often one or more members leave their households to migrate and the other members of the household stay. It is stressed that the migration decision usually is not only made by the individual migrant but also by the household he or she belongs to. Migration is in this approach interpreted as a risk-spreading mechanism for the household; the migrants participate in the households' overall strategy of building up security measures against different risks as for instance the failure of markets. This indicates that migration is unlikely under perfect market conditions and functioning financial institutions. Also remittances migrants send back home to their families are immanent. Migrants do not send these remittances due to pure altruism but rather as individual (future) security investments for instance for having a fallback option in case the income source at the place of reception is collapsing or for assuring that in future he or she will inherit important assets, such as land or money (Ellis 2000:106). The 'household perspective' on the migration decision process also indicates that the Chayanovian implications, particularly the specific dependency ratio of a household, have a crucial impact on the migration probability (see chapter V.2). The strong focus put on the production or income factors (financial remittances) that is inherent here as well as in the economic migration literature in general largely excludes considerations that migration (in particularly seasonal migration) can be an insurance measure to guarantee the food security of a household by the absence of one or more consumers (see chapter IV.3).

An aspect the recent economic research on migration research emphasizes is the meaning of culture and tradition (two factors which Stark (2003) assembles in the word 'taste'). Especially the cultural attitude towards migration plays an important key role in this context. Stark (2003) has shown that a family, kinship group, a certain ethnic group

or even a whole society with a certain cultural disposition towards migration will most-likely bring up more migrants than a society or a group that does not have such a disposition. At his point, the economic research on migration determinants is approximating the migration research in the social sciences.

In the older sociological literature on migration, the centre of attention was rather on processes of acculturation of migrants in their host societies and related problems. The migration decision or motivation was with a few exceptions a rather neglected topic. In a macro-level perspective, Hoffmann-Nowotny (1970) explains the migration phenomenon with the migrants' wish to overcome structural tensions in their home societies being caused by differences in the distribution of power and prestige by emigrating into another society. Eisenstadt (1954) perceives the migration decision as being mainly caused by feelings of insecurity and inadequacy at the migrant's place of origin, which may be caused by diverse reasons. This push factor makes the migrant to start an inner consideration process of migration. As the migrant has to face severe uncertainties and risks, the generating of the motive is a rather gradual than an ad-hoc process with the aim to achieve economic but also socio-cultural improvements at the place of destination. However, both authors do not really overcome the traditional analysis scheme of push- and pull factors.

Recent trends in the sociological and socio-anthropological research on migration also integrate the migration decision into their research agenda and aim at overcoming the migration decision by a simplistic analysis of structural mainly socio-economic push- and pull-factors. Besides the perception and analysis of these factors, Hahn (2005) - based on de Jong and Gardner (1981) - has identified four rather 'ideal-typical' stages a migrant theoretically has to go through in an individual cognitive decision process on migration. They can be regarded as an extension to Eisenstadt's model of the migration decision process. The first step in this model is the building of a motivation concerning a possible migration process. According to Harbison (1981), several questions have to be answered cognitively by the migrant, such as whether the aspired improvement due to the migration is really available or whether the achievement of the personal goals as results of the migration process can really be seen as realistic ones. The cognitive construction of the migration motive is the precondition for any further steps. The second stage is the generating of a mental map of the potential places of destination; a

migrant has to receive information about these places that forms a certain image, which not necessarily has to represent reality. The seeking for information is a process whose final goal it is to find the greatest possible accordance between the migrants' wishes and expectations and the possibilities a certain place of reception is offering. As family members, other relatives or friends are sources of meaningful and influential information, the decision for a place might not strictly follow rational considerations. The second stage is the inner preparedness to take all risks being associated with the decision to migrate. This preparedness is rather the outcome of the previous stages than an immediately appearing state of mind. It is the final positive answer to the question whether the migration with all its consequences is wanted or not. The decision to migrate is the final stage. In this stage, which virtually combines the migrant's preparation process with his or her beginning transition process, the family is a crucial factor. In this migration decision stage model, it is important that the migrant's family acts as an intermediary agency between the migrant and the potential places of reception. The family is not only giving or denying support, it is also providing information and consequently the migration decision here is also (partly) embedded in the specific norm and value system of the migrant's family.

Drawing on the often expressed need to include more findings on cultural or values- and norm-related influences in theoretical consideration on migration processes (e.g. Hugo 1981), Hahn and Klute (2007) go one step further and suggest that the migratory decision process has to be seen as a complex of cultural representations. The decision process is taking place in a wider focus than just the family. This means that the starting point of the analysis are the migrants themselves and their places of origin, the places where 'future migrants are raised and former migrants settle after long years abroad' (Hahn and Klute 2007: 14). Hahn's and Klute's concept of the 'culture of migration' aims at focusing on the meanings of migration for the migrants themselves as well as the other groups mentioned and their very own economic and non-economic motivations and perceptions. In the authors' viewpoint, all actors including the ones who stay behind are involved in the migration process. The culture of migration is therefore not made up of fixed patterns, but it is a rather open process. Migration is for that reason an outcome of a discursive and highly interactive process between and within the different groups and the hosting society. The concept also takes into

consideration that migratory processes may not only change the migrants' identities but may also lead to cultural transformations in the society of origin that generally may affect the recently migrated, the returnees as well as the ones who stayed behind. To a large degree, this perception draws on Fortes' (1936) analysis of cultural transformations in colonial Ghana, which were especially induced by the labour migration movements (see chapter IV.2). As the 'cultures of migration'-approach sees migration as structured process that is embedded in specific values and cultural interpretations, the authors suggest to investigate into those cultural representations as the acceptance of migration itself or material contexts of migratory movements besides underlying economic motivations.

VI.2 Seasonal migration among irrigation and non-irrigation households

With regard to what was shown in chapter IV.3 and in the previous sub-chapter, it is obvious that an analysis of the importance of seasonal migration has to incorporate socio-economic as well as cultural factors on individual and non-individual level. The analysis starts with an econometric regression model to analyse the determinants of a migration decision. The model presented here is based on a migration decision probit regression model by Tsegai (2005), whose focal point is on migration determinants and trends within the whole Ghanaian Volta Basin. The chosen independent variables for the regression reflect basic considerations of the economic research on migration decisions (see chapter VI.1); table VI.1 provides a detailed overview and description of the variables chosen for the regression.

Table VI.1: Independent variables used for migration probit regression analysis on seasonal migration

Seasonal_Migration (dependent varriable)	=1 if the accordant household has one or more seasonal migrants; =0 if otherwise
Head_sex	=1 if head of household is male; =2 if head of household is female
Farm_assoc	= 1 if one or more household member is a member of a farmers association, =0 if otherwise
Mean_adult_age	= mean age of all adults of a household
Num_hhmembers	= number of household members
Dependency_ratio	= dependency ratio of the household (here calculated as: number of household members under 13 years of age + number of household members who are 65 years and older divided by the remaining number of household members)
Mig_exp_hhh	= 1 if the head of household has migration experience, =0 if otherwise
Mean_educ	= average education years of adults in a household
Income_besides_farming	= income besides farming in Cedis
Irrigation	= 1 if the household is doing SGI farming in the dry season, =0 if otherwise
Number_of_crops_in2s	= number of crops grown in two seasons
Permanent_rem	= remittances from permanent migrants in Cedis
Area_feet_rainy_s	= area of rainy season plot(s) in feet

The variables *Head_sex*, *Mean_adult_age*, *Num_hhmembers* and *Dependency_ratio* refer to the household's demography with the underlying assumption that these characteristics significantly increase the migration probability of a household; those

households with a higher number of adult members and/or a fewer number of dependents (= a low dependency ratio) will have a higher probability that one or more of their members go to the South to work than other households. The agricultural performance related variables *Number_of_crops_in2s*, *Area_feet_rainy_s* and *Irrigation* underline the assumption that the more a household is engaged in agricultural activities, the more unlikely it will be that one or more members migrate; the focus of the analysis will of course especially be on the irrigation variable. The same (negative) correlation for the migration decision likelihood is expected for the variable *Income_besides_farming*, *Farm_assoc*, *Mean_educ* and *Permanent_rem* whereas the variable *Mig_exp_hhh* is expected to increase the migration probability of a household.

Table VI.2: Probit regression on migration decision in the Atankwidi catchement[38]

Seasonal_Migration	Coef.	Std. Err.	z	P>z	Conf.	Interval
Headsex	0.13847	0.33359	0.42	0.678	-0.515371	0.79231
Farm_assoc	-0.77529	0.28439	-2.73	0.006	-1.332664	-0.21791
Mean_adult_age	-0.03084	0.01983	-1.56	0.120	-0.069714	0.00803
Num_hhmembers	0.10427	0.04463	2.34	0.019	0.016788	0.19174
Dependency_ratio	-0.00429	0.00351	-1.23	0.221	-0.011164	0.00258
Mig_exp_hhh	0.36012	0.44069	0.82	0.414	-0.503646	1.22385
Mean_educ	-0.06462	0.10147	-0.64	0.524	-0.263488	0.13427
Income_besides_ Farming	8.4e-08	8.18e-07	0.10	0.918	-1.52e-06	1.6e-06
Irrigation	-0.37805	0.34960	-1.08	0.280	-1.063258	0.30716
Number_of_crops_ grown2s	0.12258	0.11169	1.10	0.272	-0.096339	0.34149
Permanent_rem	-1.1e-06	6.42e-07	-1.85	0.064	-2.45e- 06	6.8e-08
Area_feet_rainy	6.6e-06	0.00002	0.34	0.734	-0.000032	0.00004
_cons	-070269	1.39781	-0.50	0.615	-3.442352	2.03697

Source: own presentation

The regression table VI.2 shows that (at least according to the economic standard significance levels of 99% and 95%) only the variables *Farm_assoc* and *Num_hhmembers* can significantly explain the migration decision on the household levels for the study area. This indicates that the more members a household has, the higher is its real probability of sending at least one migrant to the South to work; the (informal) farm associations as bodies of reciprocal solidarity obviously have an decreasing impact on the migration behaviour of the household as a whole.

[38] The data that has been used for this regression model is coming from the 2007 Atankwidi household survey. See Apendix 3 for the classification table. Relevant tests for multicollinearity, heteroskedasticy, etc. showed now critical results.

Table VI.3: Seasonal and permanent migration among irrigation and non-irrigation households (2007)

	Share of households with seasonal migrants (in %)	Share of households with permanent migrants (in %)
Irrigation households	31.5	41.0
Non-irrigation households	29.5	49.0
Chi²	0.65	1,04

Source: own presentation; n=150 (Atankwidi data)

However, the findings of the surveys in 2006 and 2008 suggest that the percentage of irrigation households with seasonal migrants was unusually high in 2007 (see table VI.3). In 2006, only 15.7% and in 2008 only 15.5% of the interviewed households had seasonal migrants. Apparently, the marketing failure of 2007 had an impact on the migration behaviour of those households which are into irrigation farming. Many irrigation household heads went to the South after the tomato harvest, primarily because they wanted to assure that their families have enough to eat. Their motivation was thus to compensate the missing cash income from irrigation farming and accordingly the higher food security situation with their own absence to reduce the pressure on the household's food stocks.

Table VI.4: Descriptive statistics for total mean seasonal remittances per household by irrigation and non-irrigation households (2007)

				Statistic	Std. Error
Total remittances per household	Non-irrigation households	Mean		290,357	49,578
		95% Confidence Interval for Mean	Lower Bound	188,629	
			Upper Bound	392,084	
		Median		300,000	
		Std. Deviation		262,346	
	Irrigation households	Mean		286,111	74,074
		95% Confidence Interval for Mean	Lower Bound	129,827	
			Upper Bound	442,394	
		Median		250,000	
		Std. Deviation		314,271	

Source: own presentation; n=150 (Atankwidi data)

An interesting finding is that the average but also not the median amounts of money being remitted by migrants from irrigation households and migrants from non-irrigation households do not differ significantly (see table VI.4). That is quite surprising as the migrants from irrigation households have usually a much smaller time slot to stay in the South than the migrants from non-irrigation households as the former have to work on the irrigation farms at least until February. A possible but rather speculative answer could be that migrants who are not involved in irrigation farming have to comparably spend more money on accommodation and costs of living (see below) and therefore they have fewer capacities to remit money to their households at home.

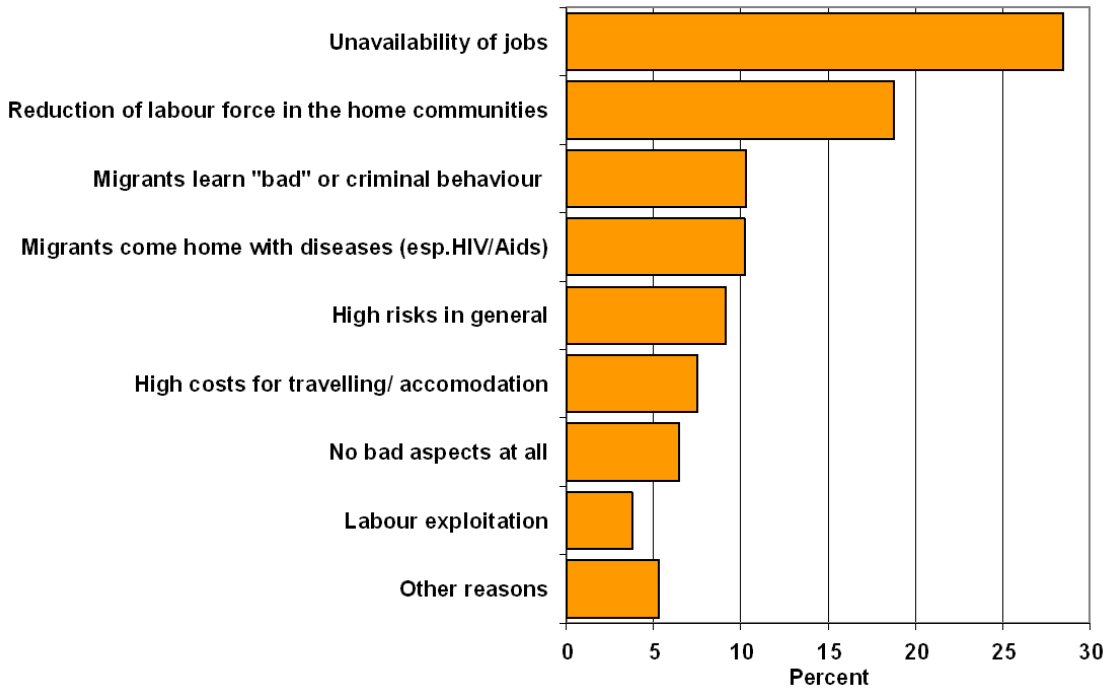
Generally, members of irrigation households seem to avoid seasonal migration whenever they can. Therefore, this remains rather an emergency livelihood option on certain conditions to secure the households' food situation. As it will be described in the following, the reasons on the one hand refer to the high acceptance of SGI as an adaptive measure; on the other hand, it refers to the number of risks and their intensity seasonal migrants have to face when they are going to the South.

VI.3 Current migration risks and the changing face of seasonal migration

Only 30% of the respondents of the 2007 survey still migrated to the South in the accordant dry season and 70% did not have recent migration experience. Accordingly, the bad aspects mentioned here represent in their majority the attitude of the former older seasonal migrants on migration issues. As figure VI.1 indicates, the unavailability of jobs is the most mentioned bad aspect associated with seasonal migration. Mentioned by more than one fourth of the respondents, this aspect is named more frequently than the 'classical' concern that seasonal migration is reducing the labour force in the migrants' home communities.

This negative aspect clearly was first choice followed by the reduction of labour force in the home communities and the fear that migrants learn 'bad' behaviour, which mainly means that they are loosing their respect towards the traditional values of their home communities or become criminal. The latter two negative aspects have existed since the very early days of North-South labour migration in pre-colonial Ghana (see chapter IV.3). This indicates that the unavailability of work in Southern Ghana for labour migrants obviously is a quite recent and severe problem. Also the fear that labour migrants return to their homes and might bring diseases like HIV/Aids with them is a commonly expressed concern. Studies on other parts of Sub-Saharan-Africa come to the result that those concerns are definitely well-founded. Coast (2005) for instance shows that seasonal labour migrants in Tanzania can be regarded as a 'bridge population' that is largely spreading HIV from urban to rural areas.

Figure VI.1: Primary bad aspects of seasonal migration mentioned (2007)



Source: own presentation; n=150 (Atankwidi catchment)

However, to gain a deeper insight into the risks and problems the migrants are facing from the perspective of the people concerned, the further results presented in this sub-chapter are particularly based on the research results of Amegashitsi (2009). Based on interviews with migrants, the findings of this study describe the situation of Northern labour migrants in the Techiman municipality (Brong Ahafo Region). This area has always been attracting labour migrants in masses due to its role as a small bread basket for Ghana. The main result is that the risks seasonal migrants from North Ghana were facing within the last two decades have not only increased in general, but the number of the different risks also went up. Furthermore, the traditional coping mechanisms of ethnicity based agency of employments and accommodation can no longer effectively approach the current hazards. The risks mentioned by the interviewed farmers of the Atankwidi catchment coincide with these research results on the actual risks existing for the migrants during their seasonal stay in Southern Ghana.

Photo VI.1: Group of seasonal migrants preparing food for a chop bar in Techiman

Source: John Amegashitsi

Among those risks are first of all difficulties concerning the access to and the preservation of the workplace. Currently, fewer and fewer of the traditional jobs (especially in the agricultural sector) are available. Unpredictable rainfall patterns, land degradation and the extended use of machinery and fertilizers are the underlying factors leading of this job insecurity. According to the OECD (2006), the high growth rates in Ghanaian agriculture of 7.5% in 2004 and 6.5% in 2005 were not at least achieved by a more intensive use of machinery and herbicides. Especially in the South Ghanaian commercial agriculture, these developments made the demand for manual labour decline within the last years. Particularly the demand for seasonal migrants to clear lands for the cultivation process, one of the most 'classical' tasks for Northern migrants in the Southern agriculture, broke away to a larger extent. However, about 70% of the seasonal migrants the 2007 survey queried were still working in jobs within agricultural fields of labour. Other employment sectors like gastronomy, mining or trading are still of less importance for the employment for seasonal migrants.

Job unavailability is a problem which the traditional kinship based networks cannot adequately cope with anymore. To find any kind of employment, the migrants have to an increasing degree resorted to free farm labourers markets. These kinds of labour markets function in the following way: the migrants are waiting at certain places like selected road sides, market sheds or lorry parks, usually with their hoes or cutlasses in their hands to demonstrate that they are looking for a farm job (see photo VI.2). By doing so, they are trying to attract potential employers for recruitment. That way, labour migrants without support by relatives and friends in their destination area, try to find an appropriate employment in the agricultural sector.

When they could manage to obtain a job, the most serious risk confronting the migrants is surely the problem of labour exploitation. Many migrants report that they worked without having been paid the full amount agreed upon or even without having been paid at all. Some of the farm jobs are even paid in kind - accommodation, feeding, share of produce among others. Furthermore, some of the female migrants reported to be victims of sexual exploitation. The underpinning elements of labour exploitation are diverse and comprise besides low payments the lack of clear service conditions and law insecurity. Consequently, the inability to maintain important social ties among the migrants themselves rises. Apart from the general economic and technological trends within the South-Ghanaian agriculture, labour exploitation is another element which undermines the traditional kinship based mechanisms of coping with the risks of seasonal migration. In addition to labour exploitation, migrants have to deal with rising costs of living and other costs. Many seasonal migrants therefore spend more money for groceries or rents than they usually earn. Accordingly, many are forced to raise a credit. Often they are not able to pay the money back. Especially high are the transportation and accommodation costs; the tariffs for a bus trip to South-Ghanaian destinations ranged between about 80.000 and 120.000 Cedis in early 2007, which is a big amount for many North Ghanaian farm households. When seasonal migrants begin to arrive in their destination areas, which is usually in the months November and December, commodity prices soar immediately. The rising prices force many migrants to begin their activities by running in debts.

Photo VI.2: Free farm labourer market in Techiman

Source: John Amegashitsi

Seasonal migrants have been and (most-likely) will continue to play an integral part in crime and criminality as both victims and perpetrators. In the communities and sometimes at the lorry parks, migrants have been defrauded and deceived by many people. On the other hand, a cursory check of police criminal records (confirmed with the Techiman Municipal Police Service), reveals that crimes like theft peak between the months of November and April with most of the culprits (arrested, tried and prosecuted) bearing Northern names. As a result, the level of mistrust by their employers towards the migrant labourers has risen. Many migrants report that it was common practice for farm owners to let them work on the farms without much supervision some years ago. Nowadays, they mainly work under strict supervision of their hirers.

Also the physical health of migrants is in danger: work-related accidents happen quite often as occupational safety is an unimportant issue for many employers. Therefore, it is a common sight to find (former) migrants with machete and hoe wounds and snake

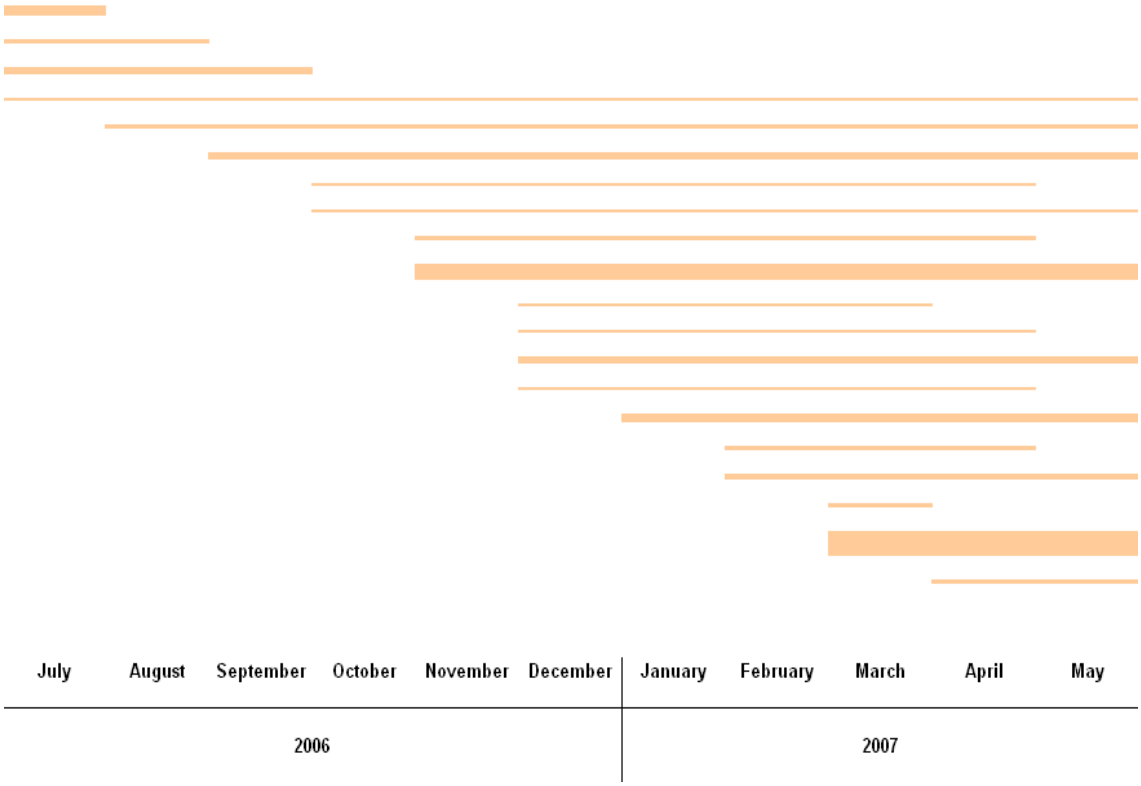
bites. Besides, the travelling itself from the North to the South is very dangerous due to the high rate of road accidents.

On account of all above mentioned risks, many of the seasonal migrants do not know when they will be able to return to their home communities. Some are forced to stay in the south due to lacking financial means. Accordingly, they become forced permanent migrants; others prefer to stay permanently because it was hard and took a very long time to get an employment at all.

The governmental and policy makers' neglect to at least provide some basic safety nets is going along with these risk factors. For instance, the 'National Health Insurance Scheme' (NHIS) policy is not yet to be fully implemented to allow for card holders to seek medical assistance all over the nation - and not only in the registered home communities. Additionally, high demands from the law courts and other social protection institutions have made it difficult for the migrants to seek redress when they meet problems.

As a result of the increased risk factors, the face of seasonal migration has changed concerning the duration of stays. The months in which seasonal migrants go to the South to work as well as the duration of their stays have altered: although still one (more or less) large November-May cluster can be recognised, the March-May cluster consisting of migrants from irrigation households was now bigger in the observed time period. And besides those two clusters, meanwhile many other migration stay schemes exist (see figure VI.2).

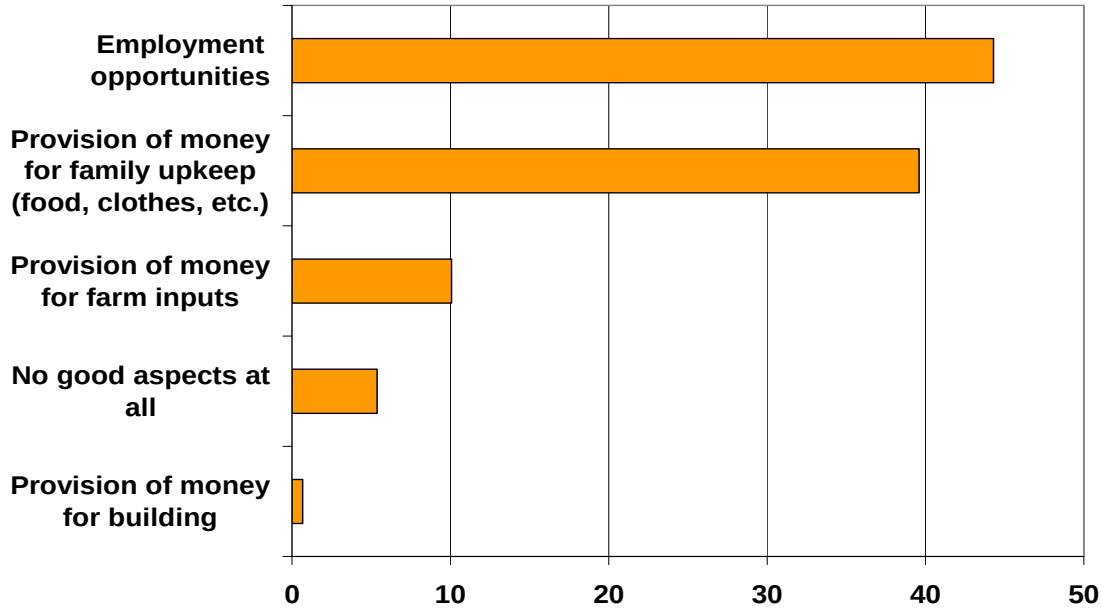
Figure VI.2: Seasonal migration calendar 2006/2007 (how many seasonal migrants stayed for how many months in the South to work)



Source: own presentation, n=65

The face of seasonal migration has changed severely not only with regard to temporal but also concerning its socio-cultural aspects. While seasonal migration in Northern Ghana was culturally highly appreciated as for example migrants have brought valuable fragments of outside knowledge to their home communities, nowadays, this traditional positive reception has nearly disappeared. Being asked about the benefits of seasonal migration, none of the interviewed farmers in the Atankwidi catchement mentioned aspects like gaining experience or 'knowledge import' related aspects that according to the older literature were of a high socio-cultural meaning in former decades. Almost half of the respondents stated that seasonal migration is good for the younger people because due to their migration stays they are employed somehow. Seasonal migration is therefore mainly perceived as something that can prevent the young ones from 'hanging around' in their home areas. The remaining answers refer to economic aspects (see figure VI.3) like money for family upkeep or money for farm inputs.

Figure VI.3: Primary good aspects of seasonal migration mentioned (2007)



Source: own presentation; n=150 (Atankwidi data)

The statements in qualitative interviews made by the seasonal migrants who had returned from the South to their home communities in the Atankwidi catchment and surrounding areas go into the same direction. Most of the migrants declare that they are feeling admired by their peers after they return from the South with some money or some nice new clothes. This admiration is frequently expressed with the Nankam term '*Ba bayang bissralama'* (I am better than them). A typical statement is the following one:

'I am better than my friends because I can buy some drinks for them and I am wearing better clothes than them' (Amalia A. 18, Kandiga)

The migrants express that this feeling of appreciation they are facing is highly depending on the quantity of money, new clothes or items they are bringing. Furthermore, it is also related to their abilities to use this money or theses items for the support of their families or the entertainment of their friends, what is perceived as a strict duty. The following statements underline this:

‘It varies from year to year. When I am able to bring some money or some clothes with me from the South, then I feel that I really can gain more respect.’ (Jacob A., 23, Zokko)

‘People here respect me now more because I have brought a bicycle for the family. The young ones respect me because of my new clothes. But I have to spend the rest of my earned money for drinks for the others so that I am respected even more.’ (Akenkure A., 22, Sirigu)

‘Some friends admire me because I am better-off than them. But this is only the case for a short while. Especially the younger ones like it very much when they see us coming back from the South with new clothes and some money. So it motivates them to go, too. Everybody here is happy and appreciates it when you can support your family’. (Ayalisike A., 29 Kandiga)

The established appreciation towards seasonal migration, which was based on the bringing in of knowledge or items unknown in Ghana’s North has disappeared. The cultural dimension was replaced by a purely economic dimension: the ability to support family and friends with financial means or food. The reasons for that can surely be found in the general development of the North: today all these items, which for a long time were only available in the South and which were representing modernity or Western lifestyle, such as nice new clothes, the most modern music players or bicycles, can now be purchased in the North Ghanaian market places too. Even in the markets of smaller communities for instance t-shirts of US-American hip-hop artists like 50 Cent or new and fancy jeans are offered for sale. Concerning the knowledge aspect, things in Northern Ghana have changed within the last decades and are still changing; e.g., about 70% of the households being interviewed in 2006, 2007 and 2008 state that they own at least one radio. Furthermore, in many district capitals of the North it is meanwhile possible to purchase a Ghanaian daily newspaper from the same day. Also the internet can more or less easily be accessed in a rising number of internet cafes in many Northern communities. Last but not least, TVs are commonly seen in many bars but also in more and more private households in North Ghana; at least 5% of the peasant households interviewed during the 2007 survey had a TV. The dissemination of knowledge does therefore no longer depend on the travelling of seasonal migrants. When Hart (1971) stated that in the early 1970s modernity was slowly travelling to

Northern Ghana, the present-day situation can be described with the estimation that modernity has been slowly arriving.

A migrant characteristic that has remained rather unchanged are the destination areas of the Northern migrants: as figure VI.4 shows, a large majority of almost 70% of the households' migrants being interviewed in 2007 is going to the Ashanti Region because of the still existing dominance of agriculture as major employment sector for seasonal migrants; the Ashanti region with its large cocoa farms for instance was and still is a centre of agricultural production in Ghana.

Figure VI.4: The regional distribution of seasonal migrants from the Atankwidi catchment area

Source: own presentation, n=65

Chapter summary

Besides economic factors, migration phenomena also comprise cultural components. As to seasonal migration in North Ghana, cultural aspects, largely based on knowledge and item transfer, have traditionally played an important role. In the present-day situation, these aspects do not matter anymore. Migration takes place due to purely economic reasons, e.g. to save food in the home households. But seasonal migrants have to face an increasing number of risks, such as labour exploitation or the insecurity of whether they can find an employment in Southern Ghana at all. Therefore, seasonal migration has become a much more 'unpopular' livelihood (adaptation) strategy within the last years. For that reason, especially members from irrigation households perceive it as an emergency livelihood when for instance the tomato market has failed and no additional cash income could be achieved.

VII Conclusion

Shallow groundwater irrigation farming is a rural livelihood adaptation process in Northern Ghana initiated as a response towards a livelihood context that is mainly characterised by processes of ecological change. These patterns of change are - as described in chapter IV.1 - mainly caused by changing climatic conditions; to a lesser extent, also local factors, such as deforestation or processes of soil erosion, are threatening subsistence farming, which still is the main livelihood of a majority of the region's population. Shallow groundwater irrigation (SGI) is an example for a purely farmer driven local innovation and adaptation process without any involvement of state agencies, NGOs or (international) donor organizations.

Its successful and rapid spread can be explained with the circumstance that it is highly relying on social capital components. They guarantee a moral economy-based access to the crucial livelihood assets of knowledge, labour and land. Irrigation farming could spread in the way it did and still does as it is strongly related to local organisational and institutional factors. Those are in particular traditional patterns of reciprocal solidarity, which are guided by accordant norms and values. Although also these patterns were influenced and weakened by colonial and post-colonial interventions (as described in chapter IV.4), they are still intact. It is still a social duty to lease an irrigation plot close to the riverside to a fellow farmer for a rather symbolic payment in forms of fowls or local gin. The same applies to the provision of hired labour. As the chapters V.1 and V.2 have shown, the social arena, for SGI are mainly patrilineal kinship clusters; accordingly, about 80% of the farmers who are currently practicing SGI have learnt about this irrigation kind from closer relatives. Furthermore, the example of this innovation process - at least concerning the dissemination of the related knowledge - can be partly regarded as support for Adger's (2005) thesis. It states that in a relative absence of the state, social capital can exceed the boundaries of a smaller solidarity bound community because many farmers, among them many 'innovators', learnt about SGI from distant relatives in other communities.

Generally, the diffusion of SGI strictly counteracts older, modernization theory driven views and argumentations. They blamed peasant norms and values, their economic

rationalities or patterns of social organization as hindering or preventative for any kind of development (see chapter V.1). SGI as a farmer driven innovation process puts forward a convincing case for a stronger reconsideration and a deeper understanding of the underlying social aspects in African small-scale agriculture as being proposed by Fairhead and Leach (2005). It is of great importance if smallholder agriculture is considered a future model rather than a yesterday's mode of production for the agricultural development of a whole continent (e.g. Toulmin and Guèye 2005) - especially with regard to its adaptive capacities in times of ecological and economic challenges and changes.

Ecological factors, such as local water scarcity or severe plant diseases, are ever reoccurring production risks connected with SGI (see chapter V.3). Chapter V.3 has furthermore shown that market failures remain a permanent and primary threat for the development of SGI. The opening and expanding of markets, e.g. via infrastructural improvements, that besides other factors has enabled the whole process has now turned out to be a risk factor. Increasing regional competition on the fresh tomato market as well as a (unfair) global competition on the processed tomato market, which is severely influenced by massive subsidies for tomato producers in Europe and North America, counteracts the development of SGI. The increasing danger of market failures became obvious in 2007. About one third of the surveyed SGI farmers stated that they made a loss as the tightly organized South Ghanaian fresh tomato traders bought the bulk of their tomatoes in neighbouring Burkina Faso. There, tomato growers have meanwhile adjusted their production in terms of quantity and time aspects to the needs of consumers in South Ghana. Due to ECOWAS agreements, the Ghanaian traders cannot be withheld to buy their commodities in the Northern neighbouring country. So far, the reopening of the Pwalugu tomato canning factory did not manage to establish a (serious) second market channel for small-scale tomato producers in Northern Ghana besides the very powerful fresh tomato trader association from Southern Ghana, who by the means of collective action can manage to dictate prices and thus cause massive trouble for the factory's attempt to buy tomatoes. This difficult marketing environment clearly underlines that farmers in the region are indeed 'double-exposed' (O'Brien and Leichenko 2005) not only to environmental but also to economic challenges at the same time. It furthermore also shows that livelihood adaptation is not a one-dimensional

process, but it is a process, which is affected by multiple social, political, ecological or economic factors.

However, despite the partly severe marketing problems, SGI has enabled many peasant households to reduce their vulnerability and to raise their standard of living, particularly by increasing their food security (see chapter V.4). Data from surveys being conducted in the years 2006, 2007 and 2008 show that even with the huge market failure of 2007, the average welfare levels of SGI households - being measured by the possession of livestock and certain household assets - rose massively by 80%. Moreover, on account of SGI many women of respective households do less labour-intensive off-farm labour activities like trading with the need of (at least) initially high investment costs. The accordant adaptive effects of SGI are very solid although its environmental sustainability is questionable. Likewise it remains to be seen how the social sustainability of this adaptation kind will develop with regard to the resilience of the social cooperation and solidarity forms under increasing cash incomes and rising living standard levels. Besides Polanyni's (1944) groundbreaking and influential work, many studies have analysed how profound economic reform processes have reshaped cultural and social patterns. Elwert (1987) for instance has shown that expanding markets can also suppress reciprocal bonds and solidarity norms.

These desiderata or unanswered questions indicate the need for more research on certain sustainability aspects; particularly soil quality studies could be conducted in order to monitor the fertility developments of SGI farm plots. The aim would be to scientifically clarify whether there are erosion processes, and if so, how severe they are. Furthermore, hydrological research could deliver answers about the medium- and large-scale impacts of SGI for instance on groundwater or riverflow issues. Finally, future social science research would have to analyse the underlying social institutional and organisational setting, a key factor for the diffusion of SGI, in order to find out about the mentioned 'robustness' of reciprocal solidarity bonds under the condition of expanding markets and market economy. Additionally, farmers need more professional technical supervision to reduce their vulnerability, e.g. towards plant diseases or temporary water shortages.

However, seasonal migration has not only due to the success of SGI become less popular as adaptation and coping strategy within the last years despite its traditional high appreciation, which was mainly associated with economic reasons (see chapters IV.2 and IV.3). These economic aspects are based on the local perception of seasonal migration as a food saving strategy; the remittance of money, food or certain items is of course appreciated, but it is rather of a secondary importance. As chapter VI.2 shows, on average only about 15% of the households involved in SGI have seasonal migrants in years with a good marketing situation as to the households the rate of seasonal migration is more than 30%. According to findings of Amegashitsi (2009), the risks seasonal migrants have been facing recently during their stays in the South have severely increased: a rising insecurity of finding employments, difficulties to find accommodation, high crime rates - with migrants as victims and offenders -, a related excessive indebtedness and an ever increasing problem of labour exploitation are meanwhile severe problems. In consequence of these circumstances, many migrants face an increasing uncertainty whether they can return to their home households at all. Furthermore, this also gives a further 'push' towards more permanent migration. Once migrants obtain secure jobs, their willingness to give them up again drops significantly The rate of permanent migration is already quite high with about one third of SGI households and half of the non-SGI households having former members as permanent migrants. The general tightening in the traditional South-Ghanaian migrant labour markets is mainly caused by modernization or mechanization processes in the agricultural sector in Southern Ghana, which is still the employment sector that attracts by far most of the Northern migrants. These insecurities are a severe challenge for the established kinship- and ethnically-based 'Northern' social networks, on which the seasonal migrants could usually rely with regard to the mediation of jobs and accommodation during their stay in Southern Ghana (see chapter VI.3).

Chapter VI has shown that besides the toughening of living and working conditions in the migrants' destination areas, the rising unattractiveness for going to the South is also related to the traditional socio-cultural function of seasonal migration as importing instrument of modernity or knowledge from Southern Ghana. This traditional cultural appreciation of migration in Northern Ghana has widely diminished as well. This is related to the general development of Northern Ghana and particularly to the

development of the media environment; for instance about 70% of the interviewed households in the mentioned surveys state to posses a radio. Furthermore, the distribution of TVs, daily newspapers and the internet has also contributed to the present-day situation. Knowledge can easily be accessed even by remote rural communities of Northern Ghana. Today it is possible to purchase many technical or lifestyle-related goods so that seasonal migration as a transport medium to acquire valuable knowledge and items is no longer necessary. The kind of appreciation migrants are still facing, depends on their ability to support their family and friends (if they are able to do so).

For many peasant households, seasonal migration has now become an emergency livelihood or coping strategy in case food insecurity needs to be mitigated. Due to the adaptive effects of SGI, members of accordant households can afford to depend much less on seasonal migration than members of non SGI households. That is besides the overall household level also valid for individual economic needs, e.g. for the young men who are also interested in such individual economic requirements like the purchase of music players or the ability to entertain friends. As already mentioned at the beginning of this thesis, the choice of the livelihood (adaptation) strategies of seasonal migration and irrigation farming is not a simple either-or decision. However, SGI as a difficult but also profitable and beneficial strategy has contributed to a minimization of seasonal migration. The factors that for the case of SGI still provide a good working order - the facilitation of necessary livelihood assets (land, labour, knowledge) via a deep embeddedness in the local social and institutional setting - more and more fail to deal with the risks and threats associated with seasonal migration; the migration related livelihood assets (jobs, accommodation) can no longer be facilitated by the migrants' social networks at the destination areas as easily as in former times. Similar to some of the risks and problems related to SGI, the serious limitations associated with seasonal migration are mainly caused by macro-economic transformations.

Generally, the thesis has shown that it may be useful to adapt the livelihood approaches as they were introduced and further developed by authors like Ellis (2000) or Scoones (1998) in order to conceptualise the analysis of local and farmer driven livelihood adaptation processes. Particularly, institutional and organizational components are crucial key factors in the identification of driving factors of adaptation processes. As a

large part of the accordant literature is still rather top-down oriented and first of all perceives the adaptation of rural livelihoods predominantly as a facilitating task for donor agencies, state actors or NGOs, there is definitively a need for more studies on such local farmer driven processes. The thesis has moreover proven that the combined research methodology of applying quantitative approaches (household surveys, GIS data) and qualitative methods (semi-structured interviews) is a necessity to be able to assess the complex and interwoven structures and processes of livelihood (adaptation) strategies in a rural African context.

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Appendix

Appendix 1 Questionnaire for the 2007 household survey

Date of interview: ……../……../ 2007, No.:_____
Name of Interviewer: ……..…….....

1. General Household Data

1.1 Name of village: _____ Community: _____
1.2 Name of household head:
_____
1.3 Household number: _____ According to Julia's data: _____
1.4 Household composition: how many people are currently living here (including seasonal migrants)?

Num-ber	**Relation-ship to the household head** **Use code***	**Sex** 1 Male 2 Female	**Age** in years	**Which educational level has this member ever reached?** **Use code****	**Had this household member any diseases or parasites during the dry season?** **(*Multiple answers possible*)** **Use code*****
EX.	**3**	**1**	**25**	**2**	**1**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					

***Relative code**
1 Himself/Herself **4** Sister/brother **7** Grandson/-daughter
2 Wife/husband **5** Mother/Father **8** Other relative
3 Son/daughter **6** Grandmother/-father **9** Non-relative

****Education code**
1 No education **6** Vocational school
2 Primary school **7** Polytechnic
3 JSS **8** University
4 Middle school **9** Other (specify)
5 SSS

*****Diseases code**
1 Malaria **6** Bilharzias
2 Typhoid fever **7** Dysentery
3 Yellow fever **8** Other (specify)
4 Cholera
5 Worms (e.g. Guinea worm)

1.5 Are you involved in social leadership? _____ Code:

1 no	4 section head	7 youth leader	10 others: _____
2 chief	5 clan head	8 leader of farmer group	
3 tindana	6 sub-clan head	9 any religious position	

1.6 Do you or any household member belong to a farmer group or an association?

1. Yes
2. No _____

1.6a If yes: cite the name and purpose of this group or association:

_____

1.6b If no: why are you not interested? (Keywords)

_____

_____

1.7 What assets do your household own?

Asset	tick	Quantity of owned asset
Tractor:		
Car:		
Motorbike:		
Bicycle:		
Donkey cart:		
Motor pump:		
Knapsack:		
Color TV:		
Black & white TV		
Radio/ tape recorder:		
Sowing machine:		
Fridge/ deep freezer:		
Access to electricity:		
Bullock plough:		
Corn mill		

1.8 Did you perform a funeral in the dry season?

1. Yes
2. No _____

1.8a If yes: which amount of money did you spend for it (roughly): _____

1.9 Are you doing irrigation farming in the dry season?

1. Yes
2. No _____

If no: continue with section 2. If yes: continue with section 3

2. Non-irrigation farmers

2.1 What are the main reasons why you are not into dry-season farming? *(Multiple answers possible)*

□ No access to water close by □ Dry-season places too far away
□ Too risky □ Difficult to get area since in a different community
□ Not enough money □ Prefer seasonal migration
□ Too busy **(specify)** □ Just not interested
□ Health problems/ bad physical condition □ Other*:* _____

2.1a If the farmer is 'too busy', specify what he is doing:

_____

2.2 Did you do it in the past?

1. Yes
2. No _____

2.2a If yes: for how many years did you do it? For _____years

2.2b If yes: where did you do it? (Keywords)

_____
_____
_____

2.2c If yes: why did you stop doing irrigation farming? (Keywords)

_____
_____
_____

2.2d If yes: when did you stop doing it? _____ years ago

2.3 Are you planning to do it in the future (again)?

1. Yes
2. No
3. I do not know _____

2.3a If yes: How do you think you will raise the capital for it?

_____
_____

2.3b If yes: How do you think to get the land?

_____
_____

<u>Continue with section 4.</u>

3. Irrigation farmers

3.1 Dry season plots

Explain to the farmer that you want to know about all the <u>dry season plots</u> he is cultivating. For that, explain to him the definition of plot.

Plot ID	**Do you own the land you farm on during the dry season?** 1 Family land 2 Borrowed land 3 Executive land given to me for free	**What kind of irrigation is practiced on the plot?** 1 Bucket/well 2 Dugout with pump 3 Dam 4 Mixed	**If borrowed land: what did you give to the landowner for acquiring the plot?** 1 Traditional token (fowls, kola nuts, etc.) 2 Cash* 3 Both* 4 Nothing	**If borrowed land: what did you give to the landowner after the harvest?** 1 Traditional token (fowls, kola nuts, etc.) 2 Cash* 3 Both* 4 Nothing	**Number of dugouts/ hand dug wells per plot**	**Plot used only for dry season or for both seasons?** D Dry Season only B Both seasons	**GPS points**
1	**4**	**1**	**2 (20.000)***	**1**	**1**	**D**	**115-150**

*Please note how much money was paid

3.2 Who performed the following tasks? Did you pay for it?

For the options 'Family member' and 'Hired labor' use the family member code. E.g. when the respondent says that two of his sons helped him with the specific task, tick 'respondent himself' and write down 'S, S,' below 'Family member'.

	Respondent himself (tick)	**Family member** **Use Code***	**Labor exchange (tick)**	**Hired labor** **Use Code****	**Amount of payment**	**How many days spend for the task?**
Clearing the land						
Digging the wells						
Digging of dugouts						
Redigging of well/dugout						
Making of nursery beds						
Making of Ridges/beds						
Transplanting						
Watering						
Fertilizer application						
Weeding						
Spraying						
Sticking/mulching						
Picking of fruits						
Refilling of wells						

*Family member code: Wife =W; Son = S; Daughter = D; Brother = B, Other = _____
**Payment code 2: Payment in kind = 1; Payment in cash = 2

3.3 Input costs during the dry season

	Quantity	**Unit** **Use Code***	**Unit price or other kind of payment**	**Total amount**
Tomato seed				
Pepper seed				
Other seed				
Manure				
NPK				
Urea				
Ammonia				
Pesticide 1				
Pesticide 2				
Harvest More				
Pump (hired)				
Petrol				
Oil				
Maintenance/repairs				
Water hose				
Ropes				
Buckets				
Other:				

* Unit code: Sachet = 1; tin = 2; bowl = 3;basin = 4; mini bag = 5; maxi bag = 6; litre = 7; gallon = 8; other _____(specify) = 9

4 Irrigation history and characteristics

4.1 Who did teach irrigation farming to you?

1. Parents taught it to me
2. Brother/ sister taught it to me
3. Other family member (including husband/ wife) taught it to me
4. Other farmer taught it to me
5. Own observation/ experimentation
6. Agricultural extension service/ MOFA
7. Was shown to me when I worked as a farm boy _____

4.1a If not Agric. Ext. Service: Where did your or your teacher's knowledge come from?

1. From one of the big irrigation projects in the region (Tono, Vea, etc.)
2. From farming in the South
3. From relative(s) or other farmer(s) _____

4.2 Who decided to start with dry season farming? (Keywords)

_____

4.3 For how many years are you doing irrigation farming in the dry season now?

For _____ years

4.4 The first time you did irrigation farming: How did you get the money for it? (Keywords)

_____
_____

4.5 And ever since: How do you get the money for irrigation farming? (Keywords)

_____
_____

4.6 What kind of marketing problems did you face? (Keywords)

_____
_____

4.7 What did you do about the marketing problems? (Keywords)

_____
_____
_____

4.8 What can <u>permanently</u> be done to reduce marketing problems? (Keywords)

_____
_____

4.9. What other problems do you face with dry season farming?

_____
_____

4.10 When was the last time you have lost crops due to water shortages?

1. This year
2. Last year
3. Two years ago
4. Three years ago
5. Four years ago
6. Five or more years ago
7. Never have lost crops due to water shortages _____

4.11 Do you think that water shortages were increasing within the last years?

1. Yes
2. No _____

4.11a If yes, give reasons: (Keywords)

_____
_____

4.12 What do you think can be done about the water shortages? (Keywords)

_____
_____

4.13 What are for you the major benefits of irrigation farming? (Keywords)

_____
_____

4.14 Will you continue doing dry season farming next year?

1. Yes
2. No _____

4.14a If yes: will you grow different plants in the next dry season?

1. Yes, next year I will mainly grow
_____
2. No _____

4.14b If no: what is the reason for giving it up? (Keywords)

_____
_____

4.14c If no: what will you do in the dry season then? (Keywords)

_____
_____

14.15 What kind of irrigation farming do you prefer? (Ranking, *e.g. 1-2-3 or 2-1-3*)

1. Small dam irrigation
2. Pump irrigation
3. Bucket irrigation _____

5. Dry season crop output and use

5.1 Crop output

Plot	**Crop**	**Amount**	**Unit** **Use Code***
Plot 1	Tomatoes		
	Pepper		
	Other:_____		
	Other:_____		
Plot 2	Tomatoes		
	Pepper		
	Other:_____		
	Other:_____		
Plot 3	Tomatoes		
	Pepper		
	Other:_____		
	Other:_____		

5.2 Crop use

Crop	**Product used for household consumption**		**Amount of product sold**		**Sold where and for how much?**	
	Quantity	**Unit** **Use codes***	**Quantity**	**Unit***	**Sold where?** **Use Codes****	**Price per unit?**
Tomato						
Pepper						
Other_____						
Other_____						
Other_____						
Other_____						

***Unit code** 1 Big basin 2 Small basin 3 Bowl 4 Standard Crate 5 Big crate 6 Bag 7 Other (specify)

****Marketing code** 1 Bolgatanga market 2 Navrongo market 3 Local market 4 Along the roadside 5 On-farm to tomato factory 6 On-farm to market ladies 7 Other (specify)

5.2a If sold to factory: how did you get the crates? (Keywords)

_____

_____

5.3 What do you use your income from irrigation for? (*Multiple answers possible*)

Building	☐	Farm inputs	☐
Transport	☐	Pumping machine	☐
Household expenditure	☐	Health	☐
Education	☐	Animals	☐

Other: _____

6. Migration

6.1 What do you think are the good aspects of <u>seasonal</u> labour migration? (Keywords)

_____

_____

6.2 What do you think are the bad aspects of <u>seasonal</u> labour migration? (Keywords)

_____

_____

6.3 What do you think are the good aspects of <u>permanent</u> migration? (Keywords)

_____

_____

6.4 What do you think are the bad aspects of <u>permanent</u> migration? (Keywords)

_____

_____

6.5 Do you still go to the South to work or have you ever live permanently there? (*Multiple answers possible*)

Lived permanently in the South for some time	☐
In the past went to the South to work for some time in the year	☐
Still go to the South to work for some time in the year	☐
This year staying at home but will go again in the future	☐
Now staying at home; will not go again in the future	☐

6.3a If respondent will not go again to the South: what was the reason for giving it up or - in case of more permanent migration - coming back respectively? (Keywords)

_____

_____

6.3b If respondent is staying at home this year but is planning to go again in the future: what was the reason for staying at home this year? (Keywords)

_____

_____

_____

6.3 *Temporary* migrants

Mi-grant ID	Are there any household members who have left the household <u>for some time</u> during the last half year (and maybe still are gone)? If yes, specify the months	Sex: 1 Male 2 Fem.	Relation to the head of HH Use codes*	If not head: was it his or her decision to go and did he or she goodbye the household head? 1 Own decision, goodbyed 2 Own decision, did not goodbye 3 Sent by HHH	Age	What was the reason for this trip? 1 work 2 visit 3 education 4 purchase 5 others (specify)	Where did he or she go? *Note the town or the village and put Region acronym in brackets:* AR=Ashanti Region BAR=Brong Ahafo R. CR=Central Region ER=Eater Region GAR=Greater Accra R. NR=Northern Region UWR=Upper West R. UER=Upper East R. VR=Volta Region WR=Western Region	If it was work: in which branch did he or she work? Use codes**	If it was work: Did or she went alone or with friends or other people from your village? 1 Alone 2 With others	If it was work, how much money did or will this person remit to the house-hold?	If it was work: did or will he or she remit anything else to the household?	If it was work: How did he or she find the job? Use codes ***	If it was work: Does he or she <u>usually</u> go every year? 1. Yes 2. No
E.g.	**12 - 05**	**1**	**1**	**1**	**25**	**1**	**Techiman (BAR)**	**2**	**2**	**200.000**	**1 bag of maize**	**1**	**1**

***Relative code** 1 Himself/Herself; 2 Wife/husband; 3 Son/daughter; 4 Sister/brother; 5 Mother/Father; 6 Grandmother/-father; 7 Grandson/-daughter; 8 Other relative (specify); 9 Non-relative

**** Branches code** 1 Mining; 2 Farming; 3 Gastronomy; 4 Trading; 5 Other

*****Job finding code**
1 With help of relatives
2 With help of people with the same ethnic background
3 Without any special help

6.4 *Permanent* Migration of household members

Per-ma-nent Mig. ID	If there are any household members who <u>permanently</u> live elsewhere: since when are they living there?	Sex: 1 Male 2 Fem.	Relation to the head of HH Use codes*	If not head: was it his or her decision to go and did he or she goodbye the household head? 1 Own decision, goodbyed 2 Own decision, did not goodbye 3 Sent by HHH	Age	What was the reason for this trip? 1 Work 2 Educ. 3 Others (specify)	If it was work: which educational level has this member ever reached? Use codes**	Where did he or she go? *Note the town or the village and put Region acronym in brackets:* AR=Ashanti Region BAR=Brong Ahafo R. CR=Central Region ER=Eater Region GAR=Greater Accra R. NR=Northern Region UWR=Upper West R. UER=Upper East R. VR=Volta Region WR=Western Region	If it was work: in which branch did he or she work? Use codes ***	If it was work: how much does this person remit to the household during the last year?	If it was work: did he or she remit anything else to the household during the last year?	If it was work: How did he or she find the job? Use codes ****
E.g.	**2 years & 6 months**	**1**	**3**	**1**	**25**	**1**	**2**	**Techiman (BAR)**	**2**	**300 000**	**1 bag of Maize**	**1**

***Relative code** 1 Himself/Herself; 2 Wife/husband; 3 Son/daughter; 4 Sister/brother; 5 Mother/Father; 6 Grandmother/-father; 7 Grandson/-daughter; 8 Other relative (specify); 9 Non-relative

****Branches code** 1 Mining; 2 Farming; 3 Gastronomy; 4 Trading; 5 Other

****Education code** 1 No education; 2 Primary school; 3 JSS; 4 Middle school; 5 SSS6; 6 Vocational school; 7 Polytechnic; 8 University; 9. Other (specify)

*****Job finding code** 1 With help of relatives; 2 With help of people with the same ethnic background; 3 Without any special help

<u>If the household has no labour migrants, continue with section 7</u>

6.5 When money is remitted from migrants: what is it spent for? (*Multiple answers possible*)

Building	☐	Farm inputs	☐
Transport	☐	Pumping machine	☐
Household expenditure	☐	Health	☐
Education	☐	Animals	☐

Other: _____

6.6 Are there more or less members of your household going to the South seasonally than in the years before?

1. More
2. Less
3. No change _____

6.6a If there are more *or* less members going to the South: why is that? (Keywords)

_____

7. Livestock owned and sold

	How many do you own in the moment?	How many sold during the dry season?	How many died during the dry season due to diseases or accidents?
Bullocks			
Cows			
Donkeys			
Pigs			
Goats			
Sheeps			
Guinea Fowls			
Chicken			
Ducks			

8. Savings and credit access

8.1 Do you have any savings?

1. Yes
2. No _____

8.1a If yes, how much is it: _____ Cedis

8.2 Did you receive a credit in the past?

1. Yes
2. No _____

8.2a If yes: who was providing it?

_____

8.2b If yes: How much did you receive?

_____

8.2c If yes: for what did you spend it

_____

9. Other activities ***(Ask the woman if possible)***

For the questions 'Who does it?', use the family member code: H=Head; Wife =W; Son = S; Daughter = D; Brother = B, Other = _____O; e.g. when the respondent says that his wife and his two daughters are involved in this activity, write down 'W, D, D'.

9.1 Where are you mainly trading?

1 At the house
2 In the market
3 Other: _____

_____

Paid Farm Work

9.2 Did anyone of your household members do farm work for cash during the last dry season? (Y=1/n=2) _____

9.3 If yes: who does it? *_____

9.4 If yes: total income from farm work during the dry season? (roughly)

_____

9.5 If yes: since when are you doing it? For _____ years

9.6 If yes: Who spends the money earned from farm work for what purposes usually:

_____

Collection of Firewood

9.7 Are there persons in your household collecting firewood? _____

9.8 Who does it? *_____

9.9 Do you also sell part of this firewood? _____ (Y=1/n=2)

9.10 If yes: total income from firewood collection during one month? (roughly)

_____

9.11 If yes: since when are you selling it? For _____ years

9.12 If yes: Who spends the money earned from firewood collection for what purposes usually:

_____

Trading

9.13 Is anyone of your household involved in trading activities? (Y=1/n=2) _____ ***(in the sense of buying and reselling)***

9.14 If yes: who does it? *_____

9.15 If yes: total income from trading during one month? (roughly)

_____

9.16 If yes: since when are you doing it? For _____ years

9.17 If yes: Who spends the money earned from trading for what purposes usually:

_____

**** Family member code: Wife =W; Son = S; Daughter = D; Brother = B, Other = _____O***

Food Processing

9.18 Does anybody from your household do food processing (Y=1/n=2)

_____ ***(like brewing pito, producing shea butter, parboiling rice, making oil, etc.)***

9.19 If yes: who does it? *_____

9.20 If yes: total income from food processing during one month? (roughly) _____

9.21 If yes: since when are you doing it? For _____ years

9.22 If yes: Who spends the money earned from food processing for what purposes usually: _____

Arts/Crafts

9.23 Does anybody from your household do handicrafts (Y=1/n=2) _____

(like pottery, weaving baskets, making ropes, armlaces, leather work, etc.)

9.24 If yes: who does it? *_____

9.25 If yes: what kinds of products are produced?

_____

9.26 If yes: total income from arts/ crafts during one month? (roughly) _____

9.27 If yes: since when are you doing it? For _____ years

9.28 If yes: Who spends the money earned from arts/ craft for what purposes usually:

_____

Collection of tree products (*e.g shea nuts, fruits, etc*)

9.29 Does anybody pick tree products for selling? _____(Y=1/n=2)

9.30 If yes: who does it? *_____

9.31 If yes: total income from collection of tree products during one month? (roughly) _____

9.32 If yes: since when are you doing it? For _____ years

9.33 If yes: Who spends the money earned from tree products collection for what purposes usually:

_____

Job income besides farming

9.34 Is anybody from your household (living here) working for cash income? (Y=1/n=2)_____

9.35 If yes: who does it? *_____

9.36 If yes: total income from job(s) during one month? (roughly) _____

9.37 If yes: since when are you doing it? For _____ years

9.38 If yes: does this household member also remit money to the household from his income?

How much is it? _____

**** Family member code: Wife =W; Son = S; Daughter = D; Brother = B, Other = _____O***

Appendix 2 Selected items for the wealth indicator

Item	Weight factor
Tractor	100
Car	100
Motorbike	35
Bicycle	4
Donkey cart	8
Motor pump	40
Knapsack	4
Color TV	5
Black&white TV	3,5
Radio	1
Sowing machine	5
Refridgerator	10
Bullock plough	5
Corn mill	5
Bullock	10
Cow	8
Donkey	5
Pig	2
Goat	1
Sheep	1,5

Appendix 3 Classification table for regression analysis

Classified D ~D	Total
+ 17 8	25
- 26 91	117
Total 43 99	142
Classified + if predicted Pr(D) >= .5	
True D defined as Seasonal_Migration != 0	
Sensitivity Pr(+ D)	39.53%
Specificity Pr(-~D)	91.92%
Positive predictive value Pr(D +)	68.00%
Negative predictive value Pr(~D -)	77.78%
False + rate for true ~D Pr(+~D)	8.08%
False - rate for true D Pr(- D)	60.47%
False + rate for classified + Pr(~D +)	32.00%
False - rate for classified - Pr(D -)	22.22%
Correctly classified	76.06%

Appendix 4 Weight factors for the plants used for the construction of the 2006 rainy season values added

	Big basin	Small basin	Bowl	Bag
Early millet	152500	84722	9453	381250
Late millet	152500	84722	9453	381250
Early guinea corn	109375	60764	6781	273438
Late guinea corn	109375	60764	6781	273438
Rice	86831	48240	6664	217078
Groundnuts	83238	46243	22375	208094
Bambara beans	216982	120546	13526	542456
Soybeans	156750	87083	9680	391875
Pepper	73093	40607	10750	182732