Lessons from implementation of ecohealth projects in Southern Africa: A principal investigator’s perspective

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Abstract

Ecohealth projects are designed to garner ownership among all stakeholders, such as researchers, communities, local leadership and policy makers. Ideally, designs should ensure that implementation goes smoothly and that findings from studies benefit the stakeholders, particularly bringing changes to the communities researched. Paradoxically, the process is fraught with challenges associated with implementation. Notwithstanding these challenges, evidence from projects implemented in southern Africa justify the need to invest in the subject of ecohealth. This paper describes and discusses a principal investigator’s experience of leading ecohealth projects in Zimbabwe between 2002 and 2005, in Botswana between 2010 and 2014 and in South Africa (ongoing). The discourse is centred on issues of project management and leadership, transdisciplinarity, students’ involvement, data management, community engagement, dissemination of research findings and the role of institutions in project management and implementation. The paper concludes that the ecohealth approach is valuable and should be encouraged making the following recommendations: 1) principal investigators must have a good understanding of socio-ecological systems, have excellent project management and writing skills, 2) more than one PI should be involved in the day-to-day running of the project in order to avoid disruption of project activities in the event that the PI leaves the project before it ends, 3) researchers should be trained in ecohealth principles and methodologies at the time of building the research teams, 4) full proposals should be developed with active participation of communities and stakeholders in order to develop a shared vision, 5) involvement of postdoctoral fellows and dedicated researchers with postgraduate students should be encouraged to avoid situations where some objectives are not fully addressed because of the narrow nature of students’ work; and 6) citizen science should be encouraged to empower communities and ensure that certain activities continue after project termination.

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1. Introduction

Ecosystem approach to health, commonly referred to as the ecohealth approach, is a concept that seeks to address health issues in the context of the social-cultural and biophysical environments. It is used to understand how human related factors interact with the environment and consequently influence human health. The term ecohealth includes animal health although some tenets of the OneHealth concept want to separate the animal health component as a different field (WHO, 2009). The concept recognizes that human health depends on healthy environments and that human prosperity depends on both healthy people and ecosystems (Charron, 2012). Ecohealth is therefore better referred to as a “Field” within which there are many disciplines imbedded within transdisciplinarity. However, ecohealth is an emerging field that has not yet been thoroughly subjected to rigorous theoretical analysis. Dakubo (2013) used a case study from Ghana to illustrate how critical theoretical frameworks can be applied in ecohealth projects. The focus in this paper is placed on the ecohealth concept that the International Development Research Centre (IDRC) in Canada (https://www.idrc.ca/) developed and promoted in the past decade. The evolvement of ecohealth approach can be followed from the works of Forget and Forget (1997), Forget and Lebel (2001), Lebel (2003) and more from the influential book ‘Ecohealth Research in Practice’ edited by Charron (2012). Before publication of the book by Charron (2012), the ecohealth concept emphasized three main principles as essential for successful implementation of ecohealth projects; transdisciplinarity (integration of research methodologies and tools across disciplines including non-academic perspectives and knowledge), community participation (full engagement of communities in the research process) and social
and gender equity (identifying and addressing unfair practices and conditions that disadvantage women and other vulnerable groups in society). Based on field experiences, Charron (2012) added three principles: systems thinking (interrogating relationships among ecological, social-cultural, economic, and governance issues); sustainability (both environmentally and socially to ensure uptake and use of research findings to bring about desired changes); and knowledge to action (applying knowledge from research to improve human health and well being through an improved environment).

Although the complexity of problems prevalent in sub-Saharan Africa require a similarly comprehensive approach as that presented by the ecohealth approach, the methodology is not used much. It is therefore the objective of this paper to highlight the benefits and challenges associated with ecohealth projects. Prominence is given to issues of management of eco-health projects, the role of students as graduate research assistance, project data management, communication of project findings, community engagement (CE), social and gender equity and institutional support. The experiences of the PI are from three ecohealth projects implemented in Zimbabwe between 2002 and 2005; in Botswana between 2010 and 2014; and South Africa (ongoing). For all the projects the author was the principal investigator and the methodology used was generally similar (the ecohealth approach) but varied significantly as lessons learnt from earlier projects influenced later projects.

2. Case studies

2.1. The Zimbabwe case: opportunities for developing ecosystem based malaria control strategies in the type of irrigation schemes that goes under the name of ‘vlei’

This study, conducted between 2002 and 2005, was instigated by opportunities provided by implementation of the concept of broad-ridge and broad-furrow (BR/BF) irrigation in wetlands commonly referred to as ‘vleis’ (Mharapara, 1995). The BR/BF technology retains 30-cm depth of water in furrows for extended periods thus creating conditions suitable for growing rice there with maize or other crops with less water requirements on the ridges (Fig. 1a and b). These conditions provide ideal habitats for malaria transmitting mosquitoes. Because the vleis are usually surrounded by homesteads, mosquitoes emerging from the furrows may bite people living nearby, thus potentially increasing the number of malaria cases in the neighbourhood.

Vleis in Zimbabwe are regarded as a communal resource for grazing animals and therefore the question of who benefits from the BR/BF irrigation at the expense of others (who lose their grazing areas) is often contested in the communities. This situation requires, a mechanism for appeasing the disadvantaged groups as highlighted by Mberekro et al. (2007). The positive aspects of BR/BF which tend to outweigh the negative implications of exploiting the vleis for irrigation purposes include increased productivity that translate to reduction in malnutrition and increased disposable income for the communities. The objectives of this project were 1) to document benefits of BR/BF and weigh against the negative impacts in order to justify the exploitation of vleis through irrigation schemes; and 2) to explore opportunities for minimising malaria risks associated with the irrigation technology. The project was funded by International Development Research Centre (IDRC), Canada through the System-Wide Initiative for Malaria and Agriculture (SIMA), hence its name SIMA-Zimbabwe. The project was implemented through involvement of five postgraduate students (three Masters and two PhD degrees), whose studies focused on malaria, agriculture, social/gender equity and conflicts, respectively.

Community Research Assistants (CRAs) were recruited from the study area to assist with data collection. Because of their interest in the project the Ministry of Health and Ministry of Agricultures seconded two staff members to the project who enrolled for PhD and Masters degrees, respectively. The project area was in Zhishavane District located in the south-central part of Zimbabwe. The study vlei (70 ha) was Zungwi located in Virimajivi village and the direct beneficiaries of the BR/BF scheme were 42 out of a total of 210 households (Central Statistics Office, 2002) residing in the area.

2.2. An ecohealth approach to flood recession (Molapo) farming to reduce climate change vulnerability in the Okavango Delta, Botswana

The Botswana Ecohealth Project (BEP) was motivated by the complex problems presented by flood recession farming, commonly known as ‘molapo’ farming, in Botswana. Molapo farming is mainly practiced in the Okavango Delta (OD) where the ecosystem is fragile. The farming system benefits rural communities, particularly poor households (Bendsen, 2005; Kgathi et al., 2004; Kgathi et al., 2007). However, farmers practicing this system face constraints associated with the non-recognition of its practice and other unfavourable policies like lack of land rights by the government of Botswana. Furthermore, there are other potential problems, such as possible environmental pollution if fertilizers are applied, the exposure to risks of water-related diseases like malaria, schistosomiasis and diarrhoea; the problem of crop pests; and the overall impact variability in flooding patterns induced by climate change. In the 2009/2010 and 2010/11 farming seasons many molapo farms were not utilized as they remained flooded for extended periods and farmers were not sure when to start planting.

![Fig. 1. A typical Broad-ridge and Broad-furrow; a) under preparation and b) with maize and rice on ridge and furrow, respectively. (a) adopted from Mberekro et al. (2015) (10), (b) adopted from Mharapara.](Image)
In earlier years, most molapo farms were also not utilized because the flooded area was limited. BEP therefore sought to assess the impacts of hydroclimatic changes/variability on flood recession farming. The project had the following themes: health, agricultural production and food security based on environment/biodiversity with five cross-cutting topics, namely hydrology; geographic information systems (GIS)/remote sensing; governance and land use policy analysis; social and gender analysis; and communication. The ultimate goal of BEP was to improve the livelihoods of the molapo farming communities and to inform the government on environmental sustainability of the farming system. The project was implemented in three villages (Xobe, Shorobe and Tubu) located in northern Botswana. The villages all practiced molapo farming along the river channels on the fringes of the OD (Fig. 2). Due to variations in flooding patterns and local topography, there were variations in the types of molapo farming across the villages. Greater depth in analysis of issues was achieved through the involvement of postgraduate students (five PhDs and two MPhils) and participation of the communities ensured that the project remained relevant to the villages addressing real-life problems. As was the case for the SIMA project, CRAs were recruited to assist with data collection and three distinct Community Advisory Boards (CABs) were elected by the community. The Departments of Health, of Agriculture and of Environmental Affairs were identified as key stakeholders and hence consulted and involved in the project at the conceptualization stage. Two of the students were employees of the Department of Agriculture and that of Environmental Affairs. Other stakeholders in Ngamiland District in which the OD is located, were briefed regularly briefed on the project activities at meetings convened by the District Land Use Planning Unit (DLUPU).

2.3. Social, environmental and climate change impact on vector-borne diseases in arid areas of Southern Africa

This project on malaria and bilharzia (schistosomiasis) in southern Africa is commonly known by its acronym MABISA (Malaria and Bilharzia in southern Africa) that was coined for effective branding in the communities where the project is implemented. The MABISA project was initiated in 2013 upon realization that social and environmental determinants of health have a major influence in the epidemiology of vector-borne diseases (VBDs) and that the influence is exacerbated by climate change. Botswana, South Africa and Zimbabwe are countries faced with varying socio-economic and environmental challenges that present opportunities for studying the impact of these factors on VBDs. The project addresses the impact of social, environmental determinants and climate change on two VBDs (malaria and schistosomiasis) in specific social-ecological systems in Botswana, South Africa and Zimbabwe, focusing on dry-land ecologies and water systems (rivers, lakes, rain-fed systems, irrigation schemes) within dry-lands, with a view to develop adaptation strategies for reducing vulnerabilities due to these diseases in population health. The study sites are uMkhanayakude (South Africa), Shakawe and Ngaranje (Botswana) and Gwanda (Zimbabwe). The project has 12 postgraduate students (four Masters plus eight PhDs) and three postdoctoral fellows. In addition, the project has dedicated country coordinators and a project coordinator. Its governance structure is more enhanced than for previous projects with an overall advisory board representing all the three participating countries and more robust CABs. The advisory members hold strategic positions in their respective countries. Zimbabwe is represented by the Director of Climate Change Management Department, Ministry of Environment, Water and Climate and the Provincial Maternal and Child Health Officer in Matebeleland South; Botswana’s representatives is the national director of the Southern African Science Service Centre for Climate Change and Land Management (SASSCAL) seconded from University of Botswana and the board member from South Africa is the Provincial Malaria Coordinator.

2.4. Outcomes of the case study projects

Table 1 summarises the key outcomes and impacts of the three case study projects. In all cases a critical mass of researchers on ecohealth projects was created and the overall objectives of the projects were achieved.

3. Experiences of an ecohealth project principal investigator (PI)

3.1. Project management

In the SIMA project, the principal investigator (PI) was solely responsible for managing the project and provided overall scientific leadership. However, supervision of the students was shared with academics not necessarily part of the project. This presented problems as the academic supervisors demanded certain activities beyond the scope of the project to be done by students to meet the degree requirements. This was not always possible as the project budget had no provision for such activities, but the situation improved during the implementation of the BEP as the theme leader concept was introduced. Theme leaders were senior academics/researchers specialized in diverse fields including biomedical, social, anthropology, planning, agriculture, hydrology, forestry and GIS/remote sensing. Consequently, the quality of supervision of graduate students improved and more scientific papers were generated. In addition, a project co-PI and a project assistant were appointed to assist with project management. This
<table>
<thead>
<tr>
<th>Project title</th>
<th>Project overall objective</th>
<th>Key project outcomes</th>
<th>Key project impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunities for developing ecosystem based malaria control strategies in ‘vlei’ irrigation schemes</td>
<td>To identify factors determining malaria transmission in ‘vlei’ irrigation schemes in order to come up with opportunities for ecosystem based malaria control strategies</td>
<td>1. Broad ridge/Broad furrow irrigation system did not have impact on malaria transmission in the area 2. The Broad ridge/Broad-furrow irrigation system enhanced moisture retention in the soil, thus increasing the wet area beyond the natural ‘vlei’ limits for extended periods 3. While agricultural productivity per hectare was good the project overall impact to the community was minimal as only a few individuals benefitted resulting in land use conflicts</td>
<td>1. Significant contribution in training and strengthening of partner institutions was achieved through training of staff at Masters and PhD levels 2. The project contributed to the literature on the concept of ecosystem approach to human health through publications and presentations at various fora at a time when the concept was just introduced in Southern Africa 3. At the Knowledge-Translation workshop held at the end of the project the representative of the Environmental Management Agency (EMA) indicated that consideration to amend the act governing wetland cultivation to accommodate the Broad ridge/Broad furrow irrigation system would be made. However, when the amendment was finally done considering other aspects it upheld a ban on all wetland cultivation 4. Two PhD and 3 Masters students working on ecohealth based research projects were trained</td>
</tr>
<tr>
<td>An Ecohealth Approach to Flood Recession (Molapo) Farming to Reduce Climate Change Vulnerability in the Okavango Delta, Botswana</td>
<td>To assess the impacts of hydroclimatic changes/variability on flood recession farming</td>
<td>1. High yield potential of molapo farms on a narrow strip with optima soil moisture conditions was demonstrated and the negative consequences of excessive flooding were noted 2. Child malnutrition was observed and interventions were instituted by reviving indigenous nutritious recipes. Community awareness of malnutrition increased 3. The study on transmission dynamics of malaria in the study area contributed to the malaria elimination efforts by the Botswana Malaria Elimination Programme</td>
<td>1. As a result of the ecohealth approach that the project adopted, communities realized and accepted that they were an integral part of research projects and could influence the direction of the research. The concept of establishing Community Advisory Boards (CABs) as part of projects became an essential component of most of the projects developed at the Okavango Research Institute which hosted the project 2. Through the participation of staff from the Departments of Water Affairs, Environment Affairs and Agricultural Research and graduate students from the same departments, the project started a process of influencing policy by developing capacity of technocrats who interacted with and advised policy makers on issues of environment. Policy makers were already engaged on issues of restoration/repair of bunds and sluices and putting them into use for management of high floods. Furthermore the need to address issues of hampered regeneration of some of the woody species to ensure their stable population structures and future healthy perpetuation was brought to the attention of the relevant government department 3. The Botswana Ecohealth Project (BEP) demonstrated good stewardship in the area of ecohealth. Two of its members became founding executive committee members of ECOHESA-Network for Ecohealth Practitioners and Researchers 4. A critical mass of young academics working on ecohealth based research was created; 4 PhD and 2 Masters</td>
</tr>
<tr>
<td>Social, environmental and climate change impact on vector-borne diseases in arid areas of Southern Africa</td>
<td>To assess the impacts of social, environmental determinants and climate change on two malaria and schistosomiasis</td>
<td>1. Spatial and temporary trends of schistosomiasis were determined using both remote sensing and ground data 2. Perceptions of communities on the influence of climate change on malaria and schistosomiasis were determined 3. A framework for a stakeholder adaptation strategy to reduce vulnerabilities to malaria and schistosomiasis is being developed jointly with the stakeholders 4. Influence of socio-economic, environmental, climatic and institutional factors on transmission dynamics for schistosomiasis were determined 5. A framework for a community based malaria early warning system that uses indigenous knowledge was developed and is undergoing validation</td>
<td>1. Engagement with strategic partners for knowledge uptake was achieved: these include departments responsible for National Adaptation Plans on Climate Change, Ministry of Environment, Ministry of Health and an NGO working on water and sanitation 2. Awareness of the role of communities in research was created through training of Community Advisory Members, Community Research Assistants and general community members 3. A critical mass of young academics working on climate change and malaria and schistosomiasis has was created; 3 Postdoctoral Fellows, 7 PhD and 3 Masters</td>
</tr>
</tbody>
</table>
improved efficiency in the preparations for field trips and financial management.

The management structure for the MABISA project is more complex (Fig. 3) but resulted in much greater efficiency. As part of the lessons from the SIMA-Zimbabwe and BEP projects, MABISA has a dedicated project coordinator (secretariat) who works closely with country coordinators and the PI who, in turn, works closely with one of the co-PIs (the project has two co-PIs) in the day-to-day management of the project. The Executive Board (MEB) constituted by the PI and the two co-PIs; and serviced by the project coordinator gets guidance from the MABISA management board (MMB) through regular meetings. The whole team meets once a year to reflect on scientific progress made and plan for the coming year. The MABISA Advisory Board (MAB) constituted by country representatives (Zimbabwe, Botswana and South Africa) meets twice a year with the MEB to provide advice on project activities, particularly with regard to alignment of country needs. At a lower level, the CABs meet at least every other month to discuss project issues and give feedback to project management. Three postdoctoral fellows were recruited to assist with supervision of postgraduate students, particularly during field expeditions. Because the team is so large and diverse it was found necessary to have a team-building workshop and that helped to improve team cohesion.

Report-writing is a key responsibility of the PI and that determines whether the project continues to get funding. While much of the information is provided by students and individual researchers, consolidating the report requires a good understanding of all technical aspects of the project. Experience has shown that students and individual researchers provide good technical reports but often fail to align their reports with project objectives, leaving the PI with the task of producing a coherent report compliant with the funding agency specifications. It is important that a co-PI works together with the PI regarding these aspects to avoid the project being negatively affected when the PI leaves the institution that is hosting the project.

### 3.2. Transdisciplinarity

In line with the ecohealth principles, research teams for all the case study projects had diverse discipline backgrounds. Non-academic stakeholders and communities were considered part of the project team with clearly defined roles. They also participated in annual feedback activities and in planning meetings.

The different academic disciplines formed two distinct groupings: the social and the natural sciences. This divide is closely related to the methodologies used by the different groups with the social sciences group mainly using qualitative methods and the natural sciences group applying quantitative methods, which often posed challenges to the teams’ efforts to be truly transdisciplinary as described by Charron (2012). The natural sciences group often felt that the social scientists wasted too much time by attending to small details, particularly when dealing with communities and the latter group accusing the former for not being sensitive to community needs and paying attention to numbers only. In-house training of research teams on the principles of ecohealth, and the importance of integrating research methodologies and tools across disciplines, was helpful in bringing the two major disciplines together. Furthermore, scientific meetings where team members presented their findings made team members realize that the two science disciplines are complementary as some of the natural science data could be interpreted using qualitative data and vice versa. Over time, the natural sciences group realized that they could actually formulate hypotheses from qualitative data for more robust quantitative studies. Fig. 4 shows how simple data generated from focus group discussions (FGDs) aligned with quantitative data. In the MABISA project, community maps (Fig. 5) were useful as a starting point for generating maps using GIS. Communities indicated key area features from which global positioning systems (GPS) coordinates were taken to generate sophisticated maps.
3.3. The role of students

Table 2 shows some of the benefits (project and individual) and risks associated with utilization of students, postdocs and institutional staff in the case studies.

Asking postgraduate students to deliver on ecohealth projects is a cost-effective approach, but it has some short-comings as shown in Table 1. Once students are on scholarships, they carry out project activities at a much lower cost than would be the case if technicians and research assistants were to do the work. Overall, this approach worked well in all the three projects. Much more in-depth data were collected in order to meet the requirements of the degree programmes. Furthermore, this facilitated transdisciplinarity as the students worked side by side and shared information and experiences, not only among themselves, but also with the communities. However, there was a risk of the projects failing to meet some of their objectives as students tended to focus on their work as informed by degree research protocols. In the SIMA-Zimbabwe project this was not much of a challenge as the scope was narrow and similarly so for BEP since the project objectives were crafted around students’ protocols. In the MABISA project, however, despite having many postgraduate students (Kgathi et al., 2004), it has not been possible to fully address the project objectives through the students’ work. It should be noted that the MABISA objectives are broad and the project is implemented in three countries. The first year progress report was criticized for focusing on students results with less interest in the broader objectives. To address this, postdoctoral students and independent researchers, for example economists, were engaged to fill the gaps not addressed through the students’ work. The annual scientific meetings helped in identifying aspects of the project objectives not addressed by the students resulting in plans to address them. Involvement of many students in projects also requires strict monitoring to avoid serious overlaps of their work that might lead to plagiarism when the theses are produced.

3.4. Data management and sharing

Ecohealth projects generate enormous amounts of data but everything is not always used. In particular, information collected during PRA workshops are rarely fully utilized, yet it much money and time are used to record all these data, both for the researchers and communities involved. While it was easy to manage data for the SIMA-Zimbabwe project, it was challenging to manage data for the other two bigger projects. There was often reluctance to share information, particularly that generated by students. While, monthly and annual reports are useful in tracking progress, there is a need for the PI to have access to the raw data, particularly in cases where students may leave the project before it ends. To avoid such situations, a centralized data management policy was developed both for BEP and MABISA. All project data were to be kept by the PI who had powers to give appropriate access to other authorized users and use the data in the interest of the project. Individual researchers and students, however, kept copies of their data.

While this policy was clear and acceptable to the project teams, implementation was not easy. Data were collected in different formats but much of them were not processed regularly to produce spreadsheets. Thus, the data passed on to the PI were usually not up to date. Another issue associated with data is publishing. While

![Community map drawn by community members during a participatory rural appraisal (PRA) workshop in Gwanda, Zimbabwe.](image)

Table 2
Benefits and risks of utilizing varied actors in data collection.

<table>
<thead>
<tr>
<th>Project category</th>
<th>Project benefits</th>
<th>Individual Benefits</th>
<th>Risks to the project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postgraduate students</td>
<td>Low costs for data collection</td>
<td>Subsidized degree programme</td>
<td>Missing data on broader issues of project</td>
</tr>
<tr>
<td></td>
<td>Enhanced rigour particularly in the case of PhD studies</td>
<td>Attainment of high qualification</td>
<td>Departure on completion of degree before end of project</td>
</tr>
<tr>
<td></td>
<td>More academic publications</td>
<td>Gaining experience of other disciplines methodologies</td>
<td>Hogging of data</td>
</tr>
<tr>
<td>Postdoctoral Fellows</td>
<td>Enhanced supervision of postgraduate students</td>
<td>Salary</td>
<td>Contracts are renewed on annual basis so the PhD might leave in the middle of project implementation</td>
</tr>
<tr>
<td></td>
<td>Enhanced quality assurance in data collection</td>
<td>Research and supervision experience</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uninterrupted service</td>
<td>Opportunity to carry own research with funds already available</td>
<td></td>
</tr>
<tr>
<td>Institutional staff (technicians)</td>
<td>Guaranteed continuity</td>
<td>Salary</td>
<td>May want to stick to institutional hours of work</td>
</tr>
<tr>
<td></td>
<td>Such cadres usually have very good experience on similar work</td>
<td>Opportunities for studying for higher qualifications through research</td>
<td>May be reassigned elsewhere</td>
</tr>
<tr>
<td>Community Research Assistants</td>
<td>Usually volunteers that are only paid for opportunity cost</td>
<td>Opportunity cost money is usually very valued in poorly resourced communities</td>
<td>These are usually school leavers who may leave the community any time</td>
</tr>
<tr>
<td></td>
<td>Usually very interested in the work</td>
<td>Exposure to research work that provides experience that may get them to another community based job</td>
<td>Need close monitoring especially in initial stages</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>May not fully understand the research process</td>
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</tbody>
</table>
it is clear that students publish their own work together with other researchers who would have contributed to the work, there are often tensions regarding authorship. To address this, students who usually initiate most of the papers were given the power to determine other co-authorship in addition to their academic supervisor based on input received from other team members in line with principles of responsible authorship (Wilson et al., 2010). However, this does not mean that the students solely became responsible for the whole publication process as the main academic supervisor guides the process.

3.5. Community engagement

Community engagement (CE) is a key component of ecohealth projects (Wilson et al., 2010) and the level of such engagement determines the success of the project. All the three projects referred to in this paper had a CE component. Necessary consultations were made prior to implementing the project and in all cases, a community diagnosis workshop was conducted to help refine the research questions. Establishment of CABs and use of CRAs were efforts to make communities participate in project activities.

The three case studies all dealt with malaria and/or schistosomiasis but the SIMA-Zimbabwe and BEP projects had agricultural components. Table 3 shows results of free listing of diseases and the ranked top five diseases by the South African community. Surprisingly, schistosomiasis or malaria were not ranked in the top 5 most important diseases in any of the projects. The research team therefore had to emphasize the importance of these diseases before communities could accept the proposal’s focus on those diseases when they felt that there were other more challenging health problems. Even when communities understood the scope of the project they always expected the project to do more, particularly on other non-project activities that they considered to be priorities for their area. In such instances, the project tried to partner with other organizations working on the aspects that the community needed the most.

Although communities made a commitment at the project inception to contribute to project activities by providing some resources or using their time on the project during project implementation, the expected support was not always given. In Botswana, one community refused to provide catering services even after the food was provided by the project, preferring bought food from a nearby restaurant. This was in contrast to the South African and Zimbabwe communities that provided full catering services as long as the food was provided. As part of empowerment, the communities were asked to provide a budget for feeding workshop participants and money was provided according to the budget line items giving preference to local supplies, e.g. for vegetables and meat. As a result, catering services were much cheaper in the communities that agreed to provide the service and the level of satisfaction was also much higher.

Participation of communities in project activities was enhanced when basic training was given to leadership (CAB) instead of only training (CRAs). This was particularly so in the MABISA project where the CABs felt disempowered as the CRAs tended to know more about the project than themselves. Their enthusiasm notably increased after they were trained for four days on various aspects of the project. They were also invited to the annual planning meetings where the scientific results of the project were presented and planning for research activities for the coming year was done. Thus, each community developed an action plan aimed at achieving project aspirations.

In all project countries, the recruitment of CRAs was done through community leadership structures. The project management stipulated the selection criteria and left the actual selection to be done through the CABs or, as in the case of SIMA-Zimbabwe, councillors. This was done to avoid recruitment of CRAs that would be unacceptable to the communities. However, there was a tendency of some leaders recruiting their relatives resulting in dissatisfaction among other community members.

The ongoing MABISA project has a CE monitoring component, which was included as a result of challenges faced in previous projects. This component was intended to determine the variations of community engagement strategies (CES) among the three study countries in order to recommend best practices of community engagement for multicentre studies. The study provides information on perceptions of communities on the level of engagement with the project, and provides also information regarding the researchers’ perspective of engagement with the communities. The study is thus serving as an ongoing self-evaluation of the MABISA project and has already enhanced community participation.

3.6. Communication of research findings

Ecohealth projects focus on addressing community problems and therefore it is important that the research findings are communicated to communities and policy makers responsible for community development. In the SIMA-Zimbabwe project this important component was less emphasized during project implementation. While there was constant feedback to communities on emerging research findings, there was no strategy to guide the process. At the end of the project, knowledge translation activities were embarked on but they were not as effective as expected. Based on the SIMA-Zimbabwe experiences, the BEP and MABISA projects included a communication component at the inception stage. Thus, both projects had clearly defined communication strategies developed with the communities, which had an opportunity to decide what materials they were interested in and how the information should be best packaged. This approach is consistent with the new approach for systematically defining the dissemination strategy (Wilson et al., 2008) rather than the traditional way in which funders simply ask researchers to point out how their work would be disseminated without compelling them to demonstrate the processes (Addis, 2005). The MABISA project improved dissemination of information at the community level through partnerships with artists. During community feedback sessions, it was attempted to disseminate research findings with help from musicians, poets and comedians, who were provided with the information intended to be disseminated and they packaged it using the concept of ‘education’ (Singhal et al., 2003). Another perspective that added value to the dissemination strategy was to ask different community groups (church groups, school children, ordinary community members, etc.) to create drama, role plays or songs about the project.

<table>
<thead>
<tr>
<th>Diseases perceived to be present in the study area by community members – free listing</th>
<th>Top five ranked diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Measles</td>
<td>1. HIV/AIDS</td>
</tr>
<tr>
<td>• Asthma</td>
<td>2. Diabetes</td>
</tr>
<tr>
<td>• HIV/AIDS</td>
<td>3. Tuberculosis</td>
</tr>
<tr>
<td>• Diabetes</td>
<td>4. Blood Pressure</td>
</tr>
<tr>
<td>• Schistosomiasis</td>
<td>5. Cancer</td>
</tr>
<tr>
<td>• Diarrhoea</td>
<td></td>
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<tr>
<td>• High Blood Pressure</td>
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<tr>
<td>• Chicken pox</td>
<td></td>
</tr>
<tr>
<td>• Cancer</td>
<td></td>
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<tr>
<td>• Malaria</td>
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<tr>
<td>• Scabies</td>
<td></td>
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<tr>
<td>• Malnutrition</td>
<td></td>
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<tr>
<td>• Epilepsy</td>
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<td>• Pneumonia</td>
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without giving them any script. This process helped to identify misconceptions, expectations and the level of project CE. Branding also contributed significantly towards marketing the project and passing information to communities and stakeholders. This was done through distributing branded T-shirts and pamphlets and use of “catchy acronyms” such as SIMA-Zimbabwe, BEP, MABISA.

3.7. Social and gender equity

In line with the principles of ecohealth (Charron, 2012), social and gender equity issues were seriously considered in the design and implementation of the projects. The research team included male and female students of different age groups. Thus, researchers were appropriately assigned to specific tasks during data collection. Where sensitive female issues had to be addressed either in FGDs or interviews, female researchers were assigned to the tasks taking into consideration the age of the study participants and their perceptions of the data collector. For free participation and extraction of sensitive information, participants were grouped appropriately (males, females, young, old, leaders, herbalists, etc.). Data generated from the projects were also analysed in a manner that reflected the gender and social dimensions and that helped in the development of appropriate interventions.

3.8. Institutional affiliations

Although the PI is responsible for project management and implementation, the hosting institution is ultimately the grant holder. This is done to protect donor funds and ensure accountability. This arrangement works well if the PI remains within the host institution until project completion. In those circumstances where the PI moves to another institution, the project may be negatively influenced. In one of the case study projects and another one not described in this paper, the PI moved to another institution and the host institution insisted on retaining the grants and appointed new PIs. One of the projects was slightly affected as it was entering the writing phase, while another, still at the implementation stage, was seriously affected in this way resulting in a large sum of money being returned to the funding agency. Another institutional challenge has to do with finances. Institutions demand that local financial rules prevail and this poses challenges in multi-country studies as this results in deferential payment rates for individuals doing similar work but in different countries. In such cases the rates specified in the budget approved by the funding agency would be the fairest to apply.

4. Discussion

Generally the ecohealth experience was most satisfactory and many lessons for taking the ecohealth field further were learnt and implemented. The most important lessons learnt from the three lead projects and their implications on project outcomes are discussed in this section.

4.1. Qualifications and role of the PI

The role of PIs and their qualifications are usually well described in the requests for proposals (RFPs) by various funding agencies, for example, in the Welcome Trust Our Planet, Our Health 2015 call. For clinical studies the PI is defined as “an individual qualified by education, training and experience who assumes responsibility for proper conduct of a clinical study in compliance with written standard operating procedures (SOPs), study protocol, International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH) and Good Clinical Practice (GCP) as well as any applicable regulatory requirements” (ICH, 2016). This definition is strictly about the qualifications, usually requiring a clinician, but this definition may not entirely be suitable for ecohealth projects where PIs not only need to have strength in a particular discipline, but also should be appreciative of both social and natural scientific approaches as well as be able to transcend into other disciplines. This is important, not only for guiding the research direction, but most important for consolidating progress and final project reports. Because ecohealth research teams are generally large and involve complex budgeting and reporting, the PI must, in addition to good research leadership, have good interpersonal relations, an appreciation of financial management and good writing skills.

4.2. Challenges in achieving transdisciplinarity

While most projects claim to pursue a transdisciplinary approach, only a few truly achieve that. As stated by Charron (2012), transdisciplinarity should both be integrative in nature and include non-academics. Walter et al. (2007) define transdisciplinary research as “a process of collaboration between scientists and non-scientists on a specific real world problem”. They refer to it as the highest level of integrative research that is not as easily attainable, neither at the lowest level of integrative research (multidisciplinarity) nor at the middle level (interdisciplinarity) (Walter et al., 2007). Salmons and Wilson (2007) further emphasize the transcending nature of transdisciplinarity and according to Nicolescu (2014) the methodology of transdisciplinarity hinges on the ontological (recognition of different levels), logical (inclusion of the middle level to achieve high level) and the epistemological (emphasizing the complex nature of a new level dependent on different levels of reality) axiom. These approaches have also been defined as knowledge systems (current knowledge status), transformational (what is needed to move from current status to target status) and target (knowledge about target) (ProClim, 2016). Thus, transdisciplinary research is driven by the desire for innovation in fundamental understanding of specific problems and the knowledge demand for solving real problems by the knowledge society (Sang and Yeongho, 2002).

All three case study projects involved active participation of non-academics particularly communities and therefore, by default, may have qualified as transdisciplinary research. However, in reflecting on the fundamental theories of transdisciplinarity and the methodology that has evolved as described above, it is evident that much still has to be done to attain true transdisciplinarity. In particular the integrative aspect was always a challenge and it remains one that needs to be improved as was evident in the reports viewed by critical reviewers as a “compilation of reports from different teams working towards a common goal”, implying multidisciplinarity rather than transdisciplinarity. Training of research teams and relevant stakeholders on understanding the transcending nature of transdisciplinarity and on how to use integrative methodologies may help in moulding teams to become truly transdisciplinary. Such training must put emphasis on the systems thinking principle as that engenders transdisciplinary teams to tackle research or development issues holistically.

4.3. Appropriate utilization of students and postdoctoral fellows

From the perspective of capacity building and ensuring that the field of ecohealth be further developed, involvement of postgraduate students in ecohealth projects is a good idea. However, there is a risk of turning the projects into academic research projects focusing on specific questions usually informed by hypothesis at the expense of community and developmental needs. This negates the principles of ecohealth through paying lip service to community and developmental aspects. If students must be used for collecting data their inputs should only be complementary and not
critical to the project, implying that their departure from the project should under normal circumstance not affect project deliverables. The Ecosystem Services for Poverty Alleviation (ESPA) policy on students states that “Projects being implemented by research students associated with ESPA projects must be independent research that is additional and complementary to the main project. Student projects may not under any circumstances be associated with delivering any key outcome for the project” (ESPA, 2016). Given that senior academics/researchers are often too busy and usually con- fine their roles to supervision and guiding the research process, engagement of postdoctoral fellows and dedicated researchers who take the project as a job rather than as an avenue to attain higher qualifications seems to be a more viable option for ensuring fulfillment of project objectives. This is what made the MABISA project unique among the three projects.

4.4. Challenges in data management and publishing of research findings

In order to have a good data management system there is need to develop a policy with clear guidelines that are easy to imple- ment. Researchers and stakeholders should have a commitment and be willing to share data in line with the policy. This can only be achieved if all parties are in agreement with the management sys- tem, assured that their data are safe and that they do not lose their rights to the data. EcoHealth projects collect complex datasets that require a specialized data manager and ICT software that allows individual researchers to consistently feed data into the database. Such software should have security measures that allow differential access to the various stakeholders. While two of the case study projects had data collection policies there were no clear guidelines for operationalizing the policy and there was no framework developed to capture the complex datasets collected. As a result large datasets collected at a high costs (money and time of both communities/stakeholders and researchers) were never analysed and got lost with time. This could have been avoided if a data management system easily accessed by all team members, similar to the one described by Yoo et al., 2002 had been used.

Publishing research findings from ecohealth projects is chal- lenging. There are fewer journals that are interdisciplinary like the EcoHealth and so publications emerging from ecohealth projects are not easily noticeable even if they get published in relevant discipline journals. In her recent review, Musesengwa and Chimbari (2017) could not find publications on community engagement on the public domain but found many existing in the form of grey litera- ture and projects listed on websites of funding agencies like IDRC. This paper is the only one that addresses the ecohealth aspects of the three case study projects and yet there are more than 20 papers that have emerged from the research and published as discipline papers. Thus, promoting the ecohealth concept is not easy through academic journals except in cases where special issues focusing on ecohealth are produced. Hung Nguyen-Viet et al. (2015), in their review of ecohealth projects in Southeast Asia, acknowledged the difficulty of publishing findings of ecohealth projects noting that for 3–4 year long projects it is not unusual to get the papers published 8–10 years post project implementation. This notwithstanding, the rapid growth of the field of ecohealth is anticipated to trigger prolif- eration of journals similar to, thus facilitating earlier publication of the work.

Another challenge associated with publishing is co-authoring of papers. This often presents problems where students are super- vised by academics that are not directly involved in the project. There is a tendency of excluding some people that would have con- tributed significantly to the work. In the BEP and MABISA projects the data policy gave access to all researchers that wished to publish generic data from the project provided they declared their interests and invited interested colleagues. This, however, did not fully solve the problem as some researchers expected to be included in certain papers because of their membership of the project but not necessar- ily fulfilling the criteria for responsible authorship as stated by the International Committee of Medical Journal Editors (ICMJE) (2010).

4.5. Community engagement

A paper on CE in this Special Issue of Acta Tropica (Musesengwa and Chimbari, 2017) provides a review that includes work from the three case study projects. The review mainly analysed the grey litera- ture as there were not many articles from public domains that could be picked up using the search term ‘community engagement’. The analysis concluded that although many projects prominently indicated CE as a key component of the project, the outcomes of these activities were never documented and published in the public domain. Furthermore, the review suggests that engagement with communities is rather skewed in favour of researchers. The lead- ership of the three case study projects realized the importance of fully engaging communities and stakeholders and hence the establishment of community structures (the CABs) and promotion of citizen science (UNEP Year Book, 2014; Dickinson et al., 2010) through CRAs. The concept of budgeting for community compo- nents and giving access to such a budget to the communities has improved ownership of the projects by the communities. Simi- larly, having representation of communities and stakeholders at annual planning meetings has ensured that community needs relevant to the projects are incorporated into the projects annual plans. The ongoing CE study for the MABISA project is expected to provide an engagement strategy suitable for ecohealth multicentre studies. Engagement with stakeholders/partners (government departments, NGOs and CBO) is an area that is often taken for granted but will now need to be formalized.

4.6. Dissemination of research findings

Communication of information needs to be incorporated in the project design and should be a continuous process. While all the project proposals included a dissemination plan, only two actu- ally developed a communication strategy incorporating branding. The use of musicians and poets/comedians to disseminate infor- mation proved valuable as the communities not only connected with the musicians, but also had an opportunity to freely give their own perspectives of the project based on their real experiences and not scripts provided by the research team. While it is impor- tant to give feedback to communities, stakeholders who provide support to the communities, particularly policy makers, need to be given timely information through their official structures. This is an area that still needs attention as it facilitates sustainability of project activities beyond the project life span (Charron, 2012) of the funded research aspects in line with the ‘Knowledge to Action’ principle of ecohealth. A review of studies conducted in Southeast Asia (Nguyen-Viet et al., 2015) was sceptical about continuation of activities after cessation of donor funding and doubted the achieve- ment of policy influence by the projects. In the southern Africa case studies this aspect was emphasized as indicated in Table 1.

4.7. Financial constraints and sustainability implications for ecohealth projects

Experience from the case study projects has shown that eco- health projects are expensive and time-consuming. The projects require large teams to tackle common problems and community interests may compete with core project questions for resources. To maintain community/stakeholder enthusiasm and commit- ment to the project, some choices and trade-offs are needed and
this has implications for the budgets. Building partnerships with stakeholders interested in aspects peripheral to the project objectives provided good leverage as the partners provided additional resources expertise. The MABISA project has partnered with an NGO keen on improving water and sanitation at the South African study site and that developmental aspect added value to the project as both malaria and schistosomiasis are influenced by water supply and sanitation. Funding agencies like IDRC that understand the nature of ecohealth projects allow limited specific budgets for developmental aspects linked to the project. However, some organizations want resources strictly spent on research activities. That approach, however, negates the principle of sustainability as activities tend to shut down at project termination. Successful ecohealth projects often lead to spin-off projects that ensure continuation of some aspects of the predecessor project as noted in Southeast Asia (Nguyen-Viet et al., 2015). In our case, the MABISA project has led to the water and sanitation project and a Phase II (funded by a different funding agency) for evaluating impact of the project in line with the criteria described by Wilcox et al. (2012). Similarly the BEP project in Botswana had some of its aspects incorporated into the MABISA project.

5. Conclusion and recommendations

Despite the challenges of implementing ecohealth projects highlighted in this paper, I am convinced that ecohealth projects make a difference in communities in terms of ownership and uptake of research findings. As indicated in the case study briefs, all three projects were able to fulfill their objectives. Furthermore, communities involved in ecohealth projects are empowered and understand that they have a shared responsibility to ensure success of the projects. Training given to the community-based watchdogs (the CABs) has resulted in communities raising their ethical concerns in project implementation and demanding to have their stakes clearly defined. To work in such communities, researchers not exposed to the ecohealth approach will need to change their mind-set. Communities not exposed to ecohealth approaches are often research-naïve and constantly taken advantage of by unscrupulous researchers who collect data and never return to give feedback. The following are lessons that should be considered to make a change in the field of ecohealth in southern Africa.

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1 PIs must have a good understanding of socio-ecological systems and also have excellent project management and writing skills.
2 More than one PI should be involved in the day-to-day running of projects in order to avoid disruption of project activities in the event that the primary PI leaves the project before it ends. In this regard, both host institutions and funding agency should consider the merits of allowing PIs to transfer grants to new institutions, should they change jobs in the middle of project implementation.
3 Since no institutions of higher learning in east and southern Africa offer formal courses on ecohealth, there is need for researchers to be trained on ecohealth principles and methodologies at the time of building the research teams.
4 While researchers have the responsibility to develop project concepts, full proposals should be developed with active participation of communities and stakeholders in order to develop a shared vision.
5 Involvement of postdoctoral fellows and dedicated researchers, with postgraduate students only adding value, should be encouraged to avoid situations where some objectives are not fully addressed because of the narrow nature of students’ work.
6 Citizen science should be encouraged as that empowers communities and ensures that certain activities continue after project termination.
7 More engagement with policy makers at all stages of implementing ecohealth projects is critical for projects to achieve policy influence.

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