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PARTICIPATORY CURRICULUM DEVELOPMENT FOR TRAINING OF EXTENSIONISTS IN IRRIGATION MANAGEMENT

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ABSTRACT

The irrigation extension worker has a leading supportive role to play to ensure sustainable agricultural production. However, to be able to fulfil the various expectations of small-scale irrigation farmers with regard to technical and extension competency, adequate training of extension workers is a requirement.

This paper represents the findings of participatory curriculum development process that was followed which included the assessment of training needs of irrigation extensionists and the identification of shortcomings in the occupational profile of irrigation extensionists. These results will be used to develop a conceptual training curricula framework in irrigation management.

1. INTRODUCTION

It is generally recognised that extensionists provide an essential link between research output and solving the perceived problems which farmers experience. All types of farmers, but specifically small-scale irrigation farmers, are dependant on efficient extension services as a source of information and knowledge for sustainable agriculture production. Discussion forums organized by the Water Research Commission in all provinces in South Africa between 2000 and 2003, in

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which a wide range of farmers participated, have highlighted that the extension link has deteriorated in recent years and has become less effective.

The revitalization of small-scale irrigation schemes and irrigation management transfer is an accepted policy in South Africa. Implementation of this policy can however not succeed without efficient extension support. Presently information is available on various biophysical and socio-economic aspects of irrigation management. Although various tertiary institutions present different training curriculums, the information is not always presented in the required format and the courses are not specifically targeted to be useful for extensionists in their work environment. Wallace, Mulhall and Taylor (1996) found in this regard that many agricultural education curricula are unresponsive to socio-economic and technological changes in the agricultural sector, not involving any form of systematic training needs assessment and adopt delivery modes and mechanisms which fail to suit the reality of the situation that many irrigation extension workers are facing.

Extensionists therefore often do not have the appropriate knowledge base and skills to do their work. In many cases this results in a lack of confidence amongst extensionists, decline in their credibility and withdrawal from the community, which they should serve. There is an urgent need to restore the self-esteem of individuals and improve service delivery of the extension profession. This paper reflects on the use of the principles of participatory curriculum development in the construction of a conceptualized framework of a curriculum for the training of irrigation extensionists in irrigation management.

2. UNDERSTANDING PARTICIPATORY CURRICULUM DEVELOPMENT

Rogers and Taylor (1998) describe curriculum development as central to the teaching and learning process, which includes planning and guiding of learning by a training or teaching organization, whether it is carried out in groups or individually, inside or outside a classroom, an institutional setting or field. A curriculum therefore is perceived as a dynamic instrument that reflects both the educational purposes to be attained as well as the methods and approaches in which learning is

organized and delivered to achieve these purposes (Taylor, 1997). Thus a curriculum should change and develop as society itself develops and be responsive to the needs of the stakeholders.

One of the greatest problems associated with irrigation management training curricula is that they are often rigid and inflexible, not only in structure and content, but in the way in which they are developed. Irrigation management curricula are often perceived as a list of content, often developed authoritatively by an elite group located at the top of the hierarchy in considerable detail, which students should be taught instead of a continuous process where students are guided to learn within a given programme of education or training. Therefore, the ultimate goal of curriculum development, namely to ensure that effective mutual learning and capacity building takes place is often not articulated, because the link between curriculum and quality teaching and learning is often not well understood.

Participatory Curriculum Development (PCD) is a new innovative thinking to the hierarchical curriculum development approaches, where both the global perspectives on education and training as well as relevant local situations are addressed. The aim with this approach is to develop a curriculum from the interchanges and dialogue of experience and information between the various stakeholders in the educational and training programme. It seeks to involve educationists, irrigation farmers, extensionists, policy makers and researchers in the construction of the curriculum - including not just subject matter being taught but also the experiences and activities which the learners engage in during the course (Taylor, 1997).

3. METHODOLOGY

The process included stakeholder analysis and identification of the specific training needs. A database compiled for the search of an appropriate extension approach for South Africa (Düvel, 2002) served as a baseline document for the identification of the extension officers serving commercial and small-scale irrigation farmers. This was followed by a quantitative assessment of a stratified sample of 83 extension officers from KwaZulu Natal, Eastern Cape, Limpopo, Northwest and Mpumalanga working on small-scale irrigation schemes to identify their competency with regard to irrigation management. The

choice of selection of the survey areas were based on its representativeness of typical situation that exists on the 202 small-scale irrigation schemes that could be ascertained in South Africa (Backeberg *et al*., 1996) and accessibility. The latter was an important consideration in view of limited financial resources available for the research.

The structured interviews of extension workers serving small-scale irrigation farmers were followed by personal interviews of a stratified sample comprising 32 subject matter specialists, commercial irrigation farmers and experienced irrigation consultants and advisors in the irrigation industry to provide insight into the possible shortcomings in the occupational profile of irrigation extensionists and the training curriculum offered to them in irrigation management.

The training needs assessment by irrigation extension workers and the identification of shortcomings in the occupational profile of them were deliberated during a key stakeholder workshop that was arranged in an endeavour to develop a curriculum framework for training of irrigation extensionist.

4. FINDINGS

4.1 Distribution of extension workers serving the small-scale irrigation farmer

Since 1995 there has been a shift in the target population that the extension services of the Provincial Departments of Agriculture and the National Department of Agriculture serve. The shift is away from the commercial sector towards the small-scale farmer, to such an extent that 96.8% of extensionists have indicated that they now serve small-scale farmers.

Of the 387 extensionists who serve the small-scale irrigation sector, 93% are found in the Eastern Cape, KwaZulu-Natal, Limpopo and Mpumalanga provinces because the majority of small-scale irrigation schemes (79%) are situated in these provinces (Stevens, Düvel, Steyn & Marobane, 2005).

Table 1: Frequency distribution of extension workers serving the small-scale irrigation farmer (N=387)

Province	Sample size	
	n	%
Eastern Cape	65	17
Free State	3	0.8
Gauteng	2	0.4
KwaZulu-Natal	67	18
Limpopo	192	49
Mpumalanga	36	9
Northern Cape	3	0.8
North West	8	2
Western Cape	11	3
Total	**387**	**100**

The effectiveness and efficiency of extension is a direct function of the competency level of the extension staff. This is particularly the case in irrigation extension, where the professional nature of extension lies in the fact that it does not only deal with profound techniques or recipes, but has to adapt its message according to the unique environmental, economic, managerial and human specific situation of the irrigation farmer. In view of this, proper training and competency in irrigation management can be regarded as a basic requirement or precondition for effective extension delivery on irrigation schemes.

4.2 Training status of extensionists

Efficient agricultural extension services require of extension workers to be qualified and competent in both the disciplines of agriculture and extension. The highest formal qualifications of extension staff, consisting of frontline extension workers and those associated with support services to small-scale irrigation schemes are summarised in Table 2.

The majority of frontline extension workers (80%) have obtained an agricultural diploma, which qualifies them as agricultural technicians but does not place them in the professional category of the scientist. What is positive is the significantly higher qualification of the

Table 2: Frequency distribution of extensionists according to their extension position and highest tertiary qualification (N = 387)

Position	National Certificate/ Diploma in Agriculture		Advanced Dipl/BTech/ B-degree		BSc/BSc (Hons)		Masters/ MSc/ PhD	
	n	%	n	%	n	%	n	%
Extension workers	276	80.4	53	15.4	7	2	7	2
Supervisors and Managers	5	33	4	27	3	20	3	20
Other support services	9	32	7	24	3	10	10	34
TOTAL	**290**	**75**	**64**	**17**	**13**	**3**	**20**	**5**

supervisors and extension managers where 67% of them have an Advanced Diploma or higher qualification, while only 19.4% of the extension workers have this qualification. The significantly higher qualifications of the officers in support services are to be expected, but the consequence of this is that they should be involved much more effectively in the extension process, particularly for knowledge support purposes.

4.3 Field of subject matter specialization

It is expected of the extensionist not to have only an adequate level of tertiary training in agriculture that will satisfy the requirements of the clients to be served, but that subject matter specialisation in an appropriate field is often needed. The distribution of the fields of specialisation of extensionists responsible for the support of small-scale irrigation farmers is shown in Table 3.

Forty seven percent extensionists perceived themselves to be specialised in the field of extension, mainly through their exposure to training in extension as part of the curriculum offered for the agriculture diploma programme. Only 0.8% respondents indicated qualifications directly related to irrigation. Six percent of the extensionists are qualified in crop production while 2 percent respectively are qualified in horticulture

Table 3: Frequency distribution of frontline extension workers according to their field of specialisation in agriculture (N=387)

Field of specialisation	n	%
Extension	184	47
General agriculture	75	19
Animal healthcare	26	7
Crop production	22	6
Home economics	19	5
Animal production	16	4
Rural development	15	4
Horticulture	6	1.5
Agricultural management	5	1.3
Agricultural economics	4	1
Communication	3	0.8
Land use planning	3	0.8
Soil conservation	2	0.8
Irrigation	*2*	*0.8*
Game/wildlife production	1	0.2
Public administration	1	0.2
Soil science	1	0.2
Aquaculture	1	0.2
Crop protection	1	0.2
Total	**387**	**100**

production. These findings illustrate that the majority of extensionists working on small-scale irrigation schemes are not technically competent to render the necessary support expected by small-scale irrigation farmers with regard to irrigation management.

4.4 Non-formal training of extension officers in irrigation management

Table 4 provides a frequency distribution of respondents that have attended short courses in irrigation management.

Table 4: Distribution of extension workers indicating short courses in irrigation management as a source of knowledge support (N=83)

Short courses as source of knowledge support	n	%
Yes	24	29
No	58	70
No response	1	1
Total	**83**	**100**

Only 29% of the respondents attended short courses that were offered in irrigation management. Thirty three percent of the extension workers that have attended short courses in irrigation management were extension supervisors or managers. Short courses in irrigation management are mainly offered to extension workers by private organisations (50%) and agricultural colleges (31%) in the various provinces. A clear tendency exists that extension workers involved with more sophisticated irrigation systems (36%) like sprinkler, centre pivot and floppy irrigation systems are more exposed to short courses in irrigation management than those involved in furrow irrigation (16%).

4.5 Assessment of irrigation management knowledge by irrigation extensionists

After extensive consultation and discussions with experts in the irrigation fraternity, the following seven technical learning areas in irrigation management were identified to be important with regard to any training curricula in irrigation management offered to extensionists:

- Soil and topography of the farm (irrigation potential of different soil types; soil compaction and related problems, etc.)

- Crop production (crop growth and water requirements, sensitivity of different crops, general crop management requirements)

- Climate (influence of climate on crop growth, crop choice, irrigation requirements)

- Irrigation economics (capital investments, operational costs of different irrigation systems, drafting and interpreting of an enterprise budget, etc.).

- Irrigation engineering (soil-plant-atmosphere requirements and hydraulic principles of importance with designing and planning of an irrigation system)

- Water use efficiency on-farm (water budgets, etc.)

- Extension and institutional arrangements (group mobilisation, leadership development).

Figure 1 shows the mean knowledge assessment of irrigation extensionists on a ten-point semantic scale (where 1 = extremely low knowledge level and 10= extremely high knowledge level) with regard to the following fields of irrigation management:

- Crop production or agronomy aspects.

- Soil (cultivation practices, physical and chemical characteristics of soil, irrigation potential, water holding capacity, etc.).

- Use of climatic data (ETo, evaporation figures, rainfall, temperature, humidity, etc.).

- Irrigation economics (drafting and interpretation of enterprise budgets, compiling and preparing of business plan for irrigation farming, calculating and interpreting of irrigation operational costs, etc.).

- Irrigation engineering (maintenance of irrigation systems, delivery rate of water sources, monitoring of system efficiency, etc.).

Figure 1 illustrates how the extension officers assessed their knowledge levels regarding crop production, soil science and the use climatic data as adequate (with a mean score of 5 points and above). However it is clear that with regard to the learning areas irrigation economics and irrigation engineering, extension officers perceive their knowledge level to be inadequate, and therefore an indication of realisation among

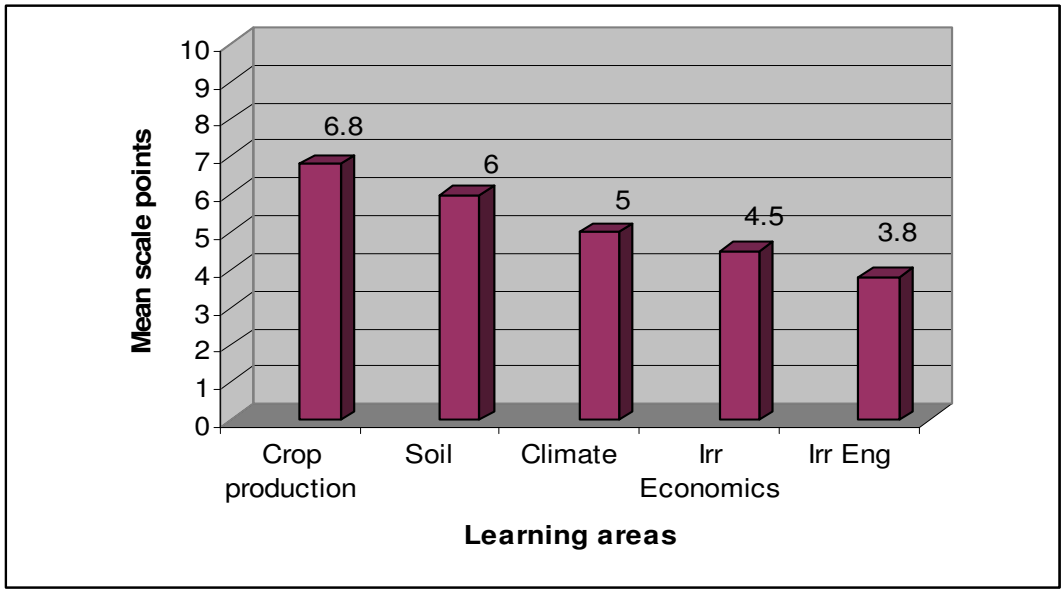

Figure 1: The mean knowledge assessment of extension workers by themselves of the different learning areas of importance in irrigation management using a 10-point semantic scale (N=83)

respondents that they require more knowledge. Perhaps this is a modest indication and not necessarily a realistic indication of the shortfall of the knowledge required, and emphasises the need for an appropriate knowledge support system.

4.6 Current educational curricula presented by tertiary institutions

An assessment of current educational curricula in irrigation management that are offered to agricultural students by tertiary institutions revealed that the majority of them allocated a fairly small percentage to training on irrigation management.

At NQF-level 6, with the exception of the University of the Free State and University of Fort Hare, where comprehensive irrigation training is offered that could lead to either a BSc Agric or a B Agric qualification, the rest have irrigation-related content included in either their soil science or plant production courses that are offered. The Universities of KwaZulu-Natal and Zululand have several trans-disciplinary programmes in agriculture, which focus on a systems approach to

sustainable agriculture and rural development. To what level irrigation planning and management is included, could not be ascertained.

The Central University of Technology (Free State Province) includes a course in irrigation design based on the content of the South African Irrigation Institute (SABI) design manual, while Tshwane University of Technology includes irrigation management as a module in the training provided to students in crop production as part of their B Tech courses offered.

At the NQF-level 5, the majority of agricultural colleges offer training in irrigation management mainly as one or two modules, which usually forms part of the fundamental training provided in crop production. However, the Lowveld College of Agricultural is the exception, where a student could specialise in irrigation management with regard to either agronomy or horticulture. At Cape Institute for Agricultural Training: Elsenburg, students receive basic training in the management and design of irrigation systems, where the curriculum content is based on the SABI Irrigation Design Manual. This training provides the students with adequate knowledge and skills to operate and manage irrigation systems on a farm-level.

4.7 Perceived shortcomings in the irrigation management training curricula

As part of the participatory approach adopted with this study, the structured interview of extension workers serving small-scale irrigation farmers was followed by personal interviews of a stratified sample comprising 32 subject matter specialists, commercial irrigation farmers and experienced irrigation consultants and advisors in the irrigation industry. The respondents' judgement of the services of irrigation extensionists to irrigation farmers on a semantic five point-scale (where 1=extremely unsatisfactory knowledge support and 5=extremely satisfactory knowledge support) with reference to the seven learning areas are summarized in Figure 2.

- This assessment contributed to provide insight into the possible shortcomings in the occupational profile of extensionists and the educational curricula in irrigation management. The following

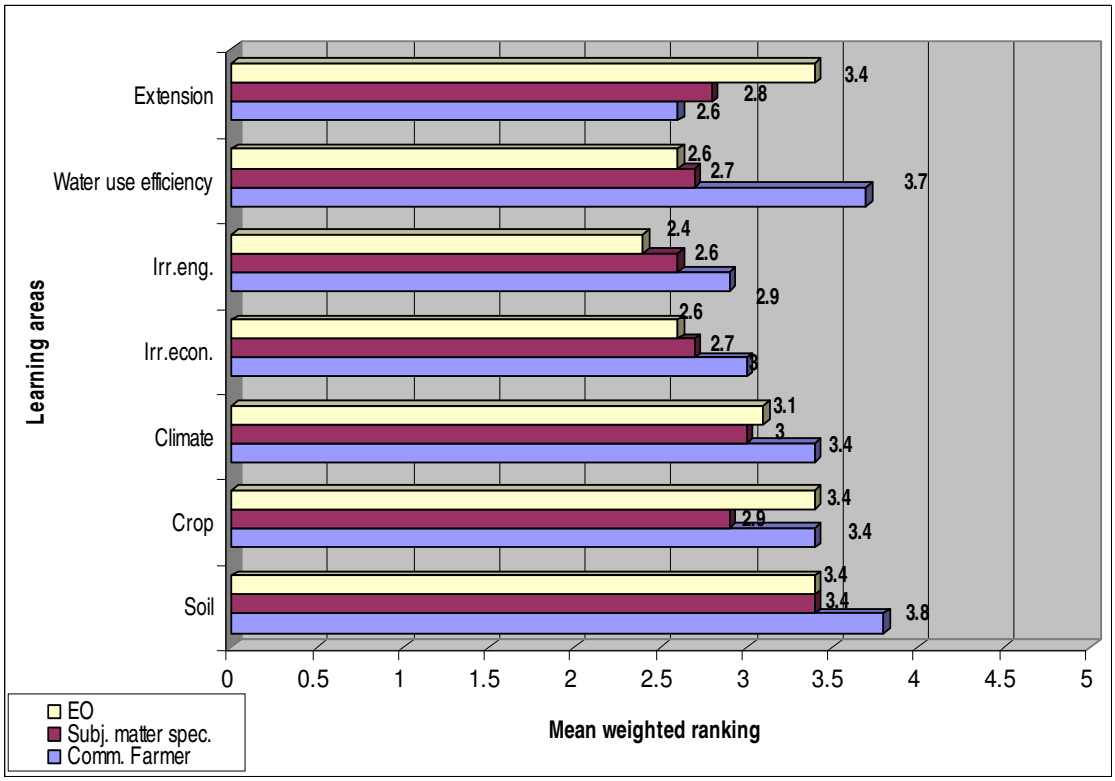

Figure 2: The mean competence of irrigation extensionist as assessed by the respondents with regard to the different learning areas (N=32)

shortcomings were identified within the current training curricula offered to irrigation extensionists:

- *Soil:* General satisfaction with regard to the knowledge and skills of extensionists on aspects of soil science. Respondents are however concerned about the technical knowledge and skills of extensionists when they are faced with problems that concern salinity, sodicity and pH problems experienced in the field. The biggest shortcoming identified with regard to current educational programmes offered is the lack of opportunities to improve the practical skills of students on the evaluation of soil properties (texture, structure, soil water holding capacity, etc.).

- *Crop production:* Respondents are relatively satisfied with the competence and knowledge displayed by extensionists with regard to crop production. However the general ability to help farmers with the calculating of crop water requirements was found to be

inadequate. The most important shortcomings with regard to the training curriculum identified are: practical skills with the application of irrigation scheduling on farm, knowledge and skills and more appropriate training with regard to the planning of weed, pest and disease management programmes under conditions of irrigation.

- *Climate (Agricultural meteorology):* The major shortcoming with regard to the current training provided to extensionists is the fact that they lack the capacity to interpret climatic data to be included into the irrigation management strategy of the irrigation farmer.

- *Water use efficiency on-farm:* The major shortcoming identified in the current training programmes is the lack of practical skills and knowledge to guide a farmer on the implementation of adapted water use strategies.

- *Irrigation engineering:* The findings on the assessment of the three groups of assessors indicated that irrigation extensionists in general are incompetent to help irrigation farmers with regard to aspects on irrigation engineering. The basic knowledge and understanding with regard to the appropriateness of infrastructure components given the crop requirements and the operating performance of the system components is often lacking among extensionists.

- *Irrigation economics:* The assessment of all the respondents showed concern about the competency level of extensionists with regard to irrigation economics. The major shortcoming with regard to current training programmes identified is the training of students in drafting a business plan for the irrigation farmer, especially within an environment of increasing water tariffs.

- *Extension and institutional arrangements:* The general weak knowledge and practical skills of extension workers on small-scale irrigation schemes with regard to the mobilisation of farmer groups and guidance on leadership development in a farmer group were identified as the major shortcomings.

5. CONCLUSION

The assessment of the occupational status of irrigation extensionists in irrigation management by subject matter specialists, irrigation consultants/advisors and farmers (small-scale and commercial) identified certain shortcomings in the training curricula offered at tertiary institutions. It is expected of the agricultural extensionists serving irrigation farming areas that they should be able to analyse, plan and advise on most of the agricultural aspects of farming with crops under irrigation. In this regard Gulhati & Smith (1967) states that: "*For productive and permanent irrigated agriculture, attention must be given not only to providing water supply, irrigating efficiently, and draining land as necessary, but also to following sound soil management practices, selecting productive crop varieties, and utilizing all beneficial cultural practices. The history of irrigation clearly points to the need for giving greater attention to the agricultural phases of irrigation*". In the light of this statement, it is a prerequisite that an agricultural extensionists should have a good academic background and practical knowledge and skills in soil science, agricultural meteorology, irrigation engineering, irrigation economics and agronomy (or horticulture or viticulture) as well as critical thinking and analytical skills for the understanding the behaviour of farmers in irrigation management.

The implementation of a programme like the revitalisation of small-scale irrigation schemes necessitates the service of competent extensionists with a multidisciplinary background and adequate knowledge in irrigation management. Unfortunately tertiary agricultural institutions tend to concentrate mainly on single disciplines, where the agricultural scientist or technician is usually thoroughly trained in only one specific discipline. Participatory curriculum development is recommended as an alternative approach in an attempt to help extensionists to restore the self-esteems and improve the service delivery of the extension profession. This approach followed in this study identified the following opportunities:

- Increased opportunities for networking of groups and individuals where new communication lines and linkages were established.
- Groups and individuals normally marginalised with regard to curriculum development were included in dialogue and discussions held.

- Stakeholders gain responsibility for various stages of the curriculum development process, which increase motivation and commitment.

The clear challenge to tertiary training institutions is to ensure that the educational curriculum responds to the demands in irrigation management necessary for sustainable agriculture development, which requires the adoption of a participatory curriculum development process.

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REFERENCES

BACKEBERG. G.R., BEMBRIDGE, T.J., BENNIE, A.T.P., GROENEWALD, J.A., HAMMES, P.S., PULLEN, R.A. & THOMSON, H., 1996. *Policy proposal for irrigated agriculture in South Africa*. Water Research Commission Report KV 96/96.

DÜVEL, G.H., 2002. *Towards an appropriate extension approach for South Africa*. Department of Agriculture, RSA.

GULHATI N.D. & SMITH W.C., 1967. *Irrigated agriculture: A historical overview*. Chapter 1 in Hagan Haise & Edminster, 1967.

STEVENS, J.B., DÜVEL, G.H., STEYN, G.J. & MAROBANE, W., 2005. *The range, distribution and implementation of irrigation scheduling models and methods in South Africa*. WRC Report No. 1137/1/05

TAYLOR, P., 1997. *Participatory curriculum development for agricultural education and training: Experiences from Vietnam and South Africa.* University of Reading, United Kingdom. *http:www.fao.org/sd/Exdirect/ Exan0226.htm).*

ROGERS A. & TAYLOR, P., 1998. *Participatory curriculum development in agricultural education: A training guide.* Rome, Italy. Food and Agriculture Organisation of the United Nations.

WALLACE, I., MULHALL, A. & TAYLOR, P., 1996. *Developing a research framework for improved policies for agricultural education and training in sub-Saharan Africa.* Reading, AERDD.