APPENDIX 1.1: EXAMPLE OF THE "OXFORD ECOLOGY TRAIL" GUIDE
BIRDS IN TOWN

Birds often thrive in towns because there are many trees, buildings and even nest boxes for them to breed in. In the country, many birds die of cold and starvation in a hard winter, but in towns food is often plentiful on bird tables and rubbish tips. The 'heat island' \[N14]\ of a town is often several degrees warmer than the nearby countryside especially near heated buildings. Breeding cycles of wild birds are mainly controlled by day-length so the extra light in city centres enables some birds to breed all the year round.

ASPECT OF TREE TRUNKS

South-facing sides of tree trunks and stonework, in the northern hemisphere, tend to be barer because more solar radiation is received per unit area. Heat from the sun evaporates any water rapidly. The drought and the heat often make conditions too extreme for plants to grow, apart from a few hardy lichens. Near the base of the tree where water can rise by seeping up the surface of the trunk (capillarity) it will be damper encouraging growth.

On both bark and stonework the damper or north-facing side is often coated with mosses or with a green powdery covering of microscopic single-celled algae such as Pleurococcus. Drier, south-facing surfaces are bare or have some lichen. However, where trunks are shaded by other trees for most of the year the south sides stay moist and also become green. Where water is prevented from trickling down a trunk by being sheltered by a branch above, bark may be dry and bare even on the north side. The side facing the prevailing wind (west or south-west in Britain) will be dried rapidly on a fine day but soaked by driving rain on a wet one. On the rest of the walk bear in mind how aspect may influence plant cover.

NORTH. Damper so more moss and richer growth of flowering plants. Cooler as no direct sunlight

WEST. Exposed to prevailing wind and rain. Warm and dry on fine days.

EAST. Cool and moist as water slowly evaporates during morning.

SOUTH. Drier and warmer. More lichens and fewer flowering plants because of full exposure to midday sun and wind.

Grassland

4. Christ Church Meadow

Ahead is the Broad Walk, a sandy, gravel path running along the northern edge of Christ Church Meadow. Stop near the far end of the college building. Several different types of grassland are visible from here. Areas of contrasting vegetation include:-

a. Lawn between the college and the Broad Walk.
b. Grass verge between the Broad Walk and the sports field ahead to your left.
c. Christ Church Meadow to the right (south) of the Broad Walk.
d. Sports field (Merton Field) ahead to your left.
e. The edge of Merton Field near the railings.
f. Plants growing on the Broad Walk itself.

Without leaving the path try to account for the different appearance of the grassland in each area. What probably controls the height of plants here?

Compare the variety of different plants present in each area and also the size and shape of these plants. Which grassland seems to have the greatest variety of species? Which has the fewest?

What controls the types of plant found in each area?

Christ Church Meadow has been left with minimum management for centuries so why has succession \[N9]\ not occurred to produce open woodland, the climax community \[N5]\ for this area?
APPENDIX 1.2: EXAMPLE OF THE "GEOLOGY AT HARTLAND QUAY" TRAIL GUIDE
STARTING THE WALK. Open out the cover to reveal the map locating the stops on the walk. The extended outside cover gives a panorama of Warren Beach from the beginning of the walk.

1. THE SLIPWAY Panorama of Warren Beach

The spectacular cliffs of Warren Beach are the result of Atlantic storms. At high tides the waves erode the base of the cliffs eventually causing parts of the undercut cliff to collapse. This has exposed a clear section through typical rocks of the district. The rocks have a stripy appearance and are folded. Notice two types of fold. In the centre of the bay are a series of tight (zigzag or chevron-type) folds. At the sides of the bay are more gentle (open) folds.

Have the folds affected the way the cliffs have eroded? Consider this when you walk along the beach. The question can be picked up again at stop 7.

Folding in the cliffs

The folding in the cliffs as viewed from the Slipway is impressive, particularly when it is remembered that these beds were originally laid down in near-horizontal layers. To get a clearer idea of the degree and complexity of the folding involved, select a prominent bed and follow it by eye across the cliff face as it is folded up and down. Do this and then check your ideas against figure 8.

The British Geological Survey (Edmunds and co-workers, 1979) in their description of this area, traced the detailed path of each bed of rock in the Warren Beach cliff (figure 8). The ‘Hartland Quay Shale’, shown as the lowest band emphasised in black in their sketch, is an easily identifiable horizon, and demonstrates the folding well. Shale is a fine-grained mudstone, which splits easily along closely-spaced bedding surfaces and can be seen from several of the stops on the walk (figure 8).

Now look at the folds more closely. Note that there are smaller, 'parasitic', folds on the limbs of the larger structures. There is a good example above the X marked on figure 8. The question of how folds develop and change perpendicular to the beds is one of the more complex concepts currently of interest to structural geologists.

Figure 8. An accurate sketch of the beds exposed in the Warren Beach cliff (reproduced with permission of the Director of the BGS. Crown/NERC copyright reserved)
APPENDIX 2: COMPREHENSIVE TRAIL DEVELOPMENT MODEL OF BEWSHER & HUGO
COMPREHENSIVE TRAIL DEVELOPMENT MODEL

ASSESSMENT

REQUEST / PROPOSAL

NEW

EXISTING

ASSESS GOALS & OBJECTIVES

TRAIL REQUIREMENTS ANALYSIS
Ecological/Emotional/Physical

PLANNING OF HIKING TRAIL CORRIDOR

PHASES:
1. Ad hoc data
2. Trail parameters
3. Ecological terrains
4. Sensitive areas
5. Trail corridor

EVALUATION

GRADING

PROPOSAL

EVALUATE

NO

DECISION - Abandon -

YES

ROUTE ALIGNMENT

COMMUNITY PARTICIPATION

IMPLEMENTATION

ADMINISTRATION
- Bookings office
- Publicity campaign
- Marketing strategy
- Maintenance programme

BROCHURES & MAFS
- Gathering of data
- Compilation
- Setwork
- Photography
- Drawing

CONSTRUCTION
- Design
- Construction
- Facilities
- Overnight huts
- Cut & fill
- Steps
- Clearing
- Water barriers

OTHER FACILITIES
- Stiles
- Bridges
- Beard walks
- Parking

MONITOR/AUDIT

OPENING

MAINTENANCE/MONITORING

AUDITING

Adapted from: Centre for Ecotourism, University of Pretoria (MLH-97)
## APPENDIX 3: RESEARCHER PARTICIPATION

### TABLE 6.2 RESEARCHER PARTICIPATION AT TSWAING: PHASE 1

<table>
<thead>
<tr>
<th>Date of researcher participation</th>
<th>Format of participation</th>
<th>Purpose of participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 1995</td>
<td>Tswaing Forum</td>
<td>Researcher introduced to the Tswaing Forum and became a member of the Tourism and the Education and Training Committees which dealt more directly with the trail planning.</td>
</tr>
<tr>
<td>8 July 1995</td>
<td>Trail site visit</td>
<td>Surveyed the proposed trail from an environmental education and ecotourism perspective.</td>
</tr>
<tr>
<td>26 July 1995</td>
<td>Trail site visit</td>
<td>Surveyed the proposed trail with the inputs from researchers from the Natural Cultural History Museum (The owner and developer)</td>
</tr>
<tr>
<td>11 and 12 August 1995</td>
<td>Trail site visit</td>
<td>Follow-up surveying</td>
</tr>
<tr>
<td>28 to 30 August 1995</td>
<td>Tour guide training</td>
<td>Trained tour guides in the following aspects; archaeology, modern history, geology, animals, ecosystems and plants of Tswaing and basic communication skills.</td>
</tr>
<tr>
<td>August 1995</td>
<td>Development of the teacher guide</td>
<td>Develop the teacher's guide with environmental education activities for the educational officer and teachers from which they can choose</td>
</tr>
<tr>
<td>8 September 1995</td>
<td>Meeting with the Education Committee at the Crater</td>
<td>Assess the draft teacher's guide</td>
</tr>
<tr>
<td>14 September 1995</td>
<td>Meeting with the education officer (Ishmael)</td>
<td>Obtain comments and inputs into the draft teachers guide. Obtain comments from two specialists at the Museum on the draft of the manual (van Coller and De Jong)</td>
</tr>
<tr>
<td>21 November 1995</td>
<td>Piloting of environmental education programmes</td>
<td>Programmes for Grades 5, 6 and 7 were piloted</td>
</tr>
<tr>
<td>23 November 1995</td>
<td>Piloting of environmental education programmes</td>
<td>Programmes for Grades 8 and 9 were piloted</td>
</tr>
<tr>
<td>24 November 1995</td>
<td>Piloting of environmental education programmes</td>
<td>Grades 11 and 12</td>
</tr>
<tr>
<td>Date of researcher participation</td>
<td>Format of participation</td>
<td>Purpose of participation</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>16 January 1996</td>
<td>Tswaing planning meeting (27 persons present)</td>
<td>Discuss the need for an environmental education centre, an environmental education community awareness programme and naming the trail.</td>
</tr>
<tr>
<td>25 January 1996</td>
<td>Walked the trail with 18 teachers from schools in the host community</td>
<td>Familiarise them with the trail environment in which the environmental education activities are planned.</td>
</tr>
<tr>
<td>2 February 1996</td>
<td>Teacher workshop at Tswaing</td>
<td>Brainstorming the draft teachers manual and the activities in the context of their own experiences of the planned target audiences, trail environment and environmental education experience</td>
</tr>
<tr>
<td>10 February 1996</td>
<td>Tswaing Forum meeting</td>
<td>Obtain the input of the meeting on the edited document</td>
</tr>
<tr>
<td>21 February 1996</td>
<td>Planning meeting</td>
<td>Get the meetings input on the edited document</td>
</tr>
<tr>
<td>April 1996</td>
<td>Final teachers guide was edited and implemented</td>
<td></td>
</tr>
<tr>
<td>Date of researcher participation</td>
<td>Format of participation</td>
<td>Purpose of participation</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>21 October 1997</td>
<td>Planning meeting</td>
<td>To inform the planning committee that UNISA (University of South Africa) and other interested organisations be involved in developing the environmental education programmes in a more structured way for the formal education sector.</td>
</tr>
<tr>
<td>24 October 1997</td>
<td>Meeting with the educational committee of Tswaing</td>
<td>The educational committee of Tswaing met to discuss the process.</td>
</tr>
<tr>
<td>28 October 1997</td>
<td>Educational committee meeting</td>
<td>Discuss the holistic and multidisciplinary approach that had to be followed. Identify sixteen activity points (a to p) and educational themes at each point were identified. Programmes were to be developed for all four phases: Gr1 to 3, Gr 4 to 6, Gr 7 to 9 and Gr 10 to 12.</td>
</tr>
<tr>
<td>25 November 1997</td>
<td>Tswaing planning committee meeting</td>
<td>Appoint four members from the host community to participate in the education committee's development of the trail. They represented the youth forum, planning committee and the Tswaing Forum.</td>
</tr>
<tr>
<td>5 December 1997</td>
<td>Site visit with the activity developers.</td>
<td>Walk the trail and visit the 16 activity sites and group them into ten stations.</td>
</tr>
<tr>
<td>9 January 1998</td>
<td>Meeting of the activity developers.</td>
<td>Group the activity developers into teams to develop specific station activities depending on their expertise. Criteria for the development of each programme was stipulated.</td>
</tr>
<tr>
<td>19 January 1998</td>
<td>Meeting with two of the senior local residents that has been in the area for many areas.</td>
<td>Obtain indigenous information about Tswaing and surrounding areas to incorporate into the activities.</td>
</tr>
<tr>
<td>9 February 1998</td>
<td>Meeting with local teachers</td>
<td>To obtain their inputs and ideas into the programmes</td>
</tr>
<tr>
<td>16 February 1998</td>
<td>Editing meeting</td>
<td>Obtain inputs on the revised activities from the whole group of activity developers</td>
</tr>
<tr>
<td>Date of researcher participation</td>
<td>Format of participation</td>
<td>Purpose of participation</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>23 February 1998</td>
<td>Editing meeting</td>
<td>To obtain inputs from the different activity developers and to decide on dates for piloting the activities.</td>
</tr>
<tr>
<td>9 to 12 March 1998</td>
<td>Piloting of environmental education programmes</td>
<td>Piloting the activities for each phase of the learner groups.</td>
</tr>
<tr>
<td>18 March 1998</td>
<td>Final editing meeting</td>
<td>To do the final editing, work in inputs and review the activities and programme as a whole</td>
</tr>
<tr>
<td>Date of researcher participation</td>
<td>Format of participation</td>
<td>Purpose of participation</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>31 January 1997</td>
<td>Trail survey</td>
<td>Visit the existing trail network to obtain background information and contextual information about the trail and the environment in which it is situated.</td>
</tr>
<tr>
<td>20 and 23 February 1997</td>
<td>Walked the trail network</td>
<td>To write down the type of environmental education information that can be found along the different sections of the trail.</td>
</tr>
<tr>
<td>25 February 1997</td>
<td>Discussion with owners</td>
<td>To discuss the different environmental education possibilities of the trail network.</td>
</tr>
<tr>
<td>26 February 1997</td>
<td>Meeting with Pretoria Technikon students</td>
<td>To discuss the possibilities of environmental education activities on the trails for which the students had to develop different environmental education programmes.</td>
</tr>
<tr>
<td>Date of researcher participation</td>
<td>Format of participation</td>
<td>Purpose of participation</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>9 September 1998</td>
<td>Trail survey</td>
<td>Visit the existing trail with Ulbe Visser to obtain background information and contextual information about the trail and the environment in which it is situated.</td>
</tr>
<tr>
<td>28 September 1998</td>
<td>Meeting with developers from the Rotary Club</td>
<td>To discuss the possibilities the trail has for environmental education.</td>
</tr>
<tr>
<td>12 October 1998</td>
<td>Meeting with developers</td>
<td>To discuss the different environmental education possibilities of the trail.</td>
</tr>
</tbody>
</table>
APPENDIX 4: MAP OF TSWAING TRAIL
APPENDIX 5: DRAFT MAP OF RUSTENBURG TRAIL
APPENDIX 6: MAP OF WINDY BROW TRAIL
APPENDIX 7: LIST OF RESOURCES ON TSWAING

Magazine articles


Reports

Untitled report from the Northern Transvaal Ornithological Society on the birds of Tswaing. Tswaing Crater Museum. TA51


Notes
The two boreholes in the crater floor.
The Carbonatite
Ejected Granite Block
The Crater Rim Section
Geology
Reservoir
The Maroela Tree
List of species of medicinal importance collected at the Pretoria Zoutpan.
Birdwatching at Tswaing. Compiled by H.D. Oschadleus.
Trees for everyday use. Tswaing Crater Museum TA56

Photos
General view of the Saltpan.
View of the Pan during the dry season, 1916.
Aerial view of the Saltpan.
Method of putting down boreholes in the Pan by hand-jumper. Southern rim with Mauss' Cutting in the background.

Maps
APPENDIX 8: MINUTES OF MEETING HELD ON 18 MARCH 1998 AT THE MUSEUM


2. Apologies: Mark

3. Report on the pilot programmes:

Programme 1: Done with grades 8 and 10 who enjoyed the mornings activities. Encountered problems with language, background knowledge, translation, graphics, experiments. The learner’s concept of environment only linked to the natural environment. The teachers shared freely and willingly and responded that it was a learning experience for them too. The cross-curricular approach and local concepts transferred to home were new to them.

Programme 2: The foundation phase programmes worked well. Translation was a problem as well as convincing the parents. Guidelines for clothing for a field trip needed. A need exists to transport the learners to the starting point of the programme otherwise time becomes a problem.

The intermediate group was shy and slowly participated. They enjoyed the activities which was new to them. Terminology in Tswana was also a problem.

Programme 3: With the intermediate phase there was a lack of participation even though the teacher accompanied them. Water is needed along the trail. Proper understanding of language and learner’s level was a problem. Rather focus on one activity than to many. Evaluation is difficult.
The foundation phase found it difficult to draw what they can not see. Long distance that had to be walked was a problem. Translation and time was problems. Did not get to k. The learner’s enjoyed the activities.

Programme 4: Water, directions, clothing and time, were problems. It was a new environment for the learners. Activities between the points are needed. Freedom to participate is a problem. Follow-up activities are needed. Techniques used in the activities were new to the learners. The school needs to take responsibility for getting the learners to Tsuaing on time.

Programme 5: Due to work constraints Louise could not pilot her activities. The meeting decided that these activities will be taken up as is and be adjusted as they are used over time.

Programme 6: Similar problems as the rest of the programmes. Rather take 1 activity and do it till the learners can master it. This programme needs a mature community leader like Chris or Ester to assist with the stories etc.

4. The way forward:

* The different activities must be adjusted and finalised by each person although activities remain flexible. Final activities must be send to Callie via E-mail or a hard copy can be send to him to be scanned in. Callie will compile the activity document. All information must reach Callie by 12 April 1998.

* Liz will get an updated map with the sites to include in the document.

* The meeting decided to give the following descriptive names to the 16 sites.

A - Nguni Cattle
B - Marula trees
C - Warming ponds
D - Salt and soda-ash factory
E - Beacon
F - Granite
G - Settlements  
H - Stone age  
I - Volcanic rock  
J - Vegetation zones  
K - Saltpan  
L - Iron age  
M - Volcanic rock  
N - Wagon road  
O - Manager's house  
P - Indaba tree

* The training of the educational officers in May 1998 must still be done names from UNISA and SACTE can be used, criteria must be identified (St 8 to 10, Sotho speaking, etc) as well as the format of the training (workshops etc?). This phase must still be negotiated with the museum.

* The activities for the education centre must still be developed. This phase must still be negotiated with the museum.

* A brochure for adult-trailists must be developed. This phase must be still negotiated with the museum.

* A report of the project must be compiled. Documents for the schools and officers must be compiled.

* Miriam and Alet will circulate the general information brochure for inputs.

5. General comments from Alet:

* It was a new experience for the learners.
* Afrikaans and English are the medium of instruction in the museums.
* Heat is a problem
* Was a positive experience for all.
* Educational programmes are never ready immediately
* There is a need for a full-time educational officer to apply and upgrade the programmes over time.
* Follow-up programmes are needed.
* A brochure is needed to tell the teacher and learner what they need and get.
* Strategies need to be build into the programmes to try and overcome problems.
* The expectations of different phases are different.
* Allow for creativity.

6. Educational officer: There is a big need for an educational officer at Tswaing. This officer can be a staff member of GDE or NW. Any good programme needs some one to implement it. Callie will formulate a motivation. The following ideas were shared by the meeting on this issue:

* The schools need to get information before the time like lists, rules etc.
* Workshops must be held to introduce the teachers to the new activities that are planned for their learners.
* It will give Tswaing a prestige value.
* The person will have to do and co-ordinate the bookings, planning, follow-up, assessment, workshops, etc.
* The person will have to compile all related documentation.
* The person will have to monitor the programmes, change and upgrade where needed.
* The person will have to compile the activity sets, group the visitors etc.
* The officer will help with the training and upgrading of the educational officers that assist on the trail, book them and co-ordinate their schedules.
* Qualifications that such a person need are: Environmental education background, PR experience, first aid knowledge, language proficiency, writing skills, people skills, etc.
7. General:
* A certificate or letter of appreciation can be given to those coming to Tswaing.
* The activity material boxes needs more thought.
* Liz will buy 50 water bottles, and some first-aid kits.
* Walkie talkies should also be introduced.

8. Next meeting:
A date was not set. A further meeting will only be held if and when it is necessary.
## APPENDIX 9: EXAMPLE FROM TSWAING TEACHER'S MANUAL - PHASE 1

### 2.3.5.2 Table of activities

<table>
<thead>
<tr>
<th>SECTION 4 (30 min walk) This section starts among the trees on the northern side of the pan. The trail continues around the edge of the pan towards the two boreholes. This section ends here.</th>
<th>Objectives</th>
<th>Information board</th>
</tr>
</thead>
<tbody>
<tr>
<td>* To understand the formation of the salt pan</td>
<td>13. Research boreholes</td>
<td></td>
</tr>
<tr>
<td>* To make use of specific skills and equipment to test the water quality and measure the water temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* To see the correlation between change in soil type and vegetation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* To identify the animals and birds around the pan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Experience the change in micro-climate from the rim to the pan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Themes</th>
<th>Salt pan</th>
<th>Water</th>
<th>Animals/Birds</th>
<th>Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activities</td>
<td>* Feel the white deposit on the rim of the pan. What is it? How did it form? [PS/HS/G/3]</td>
<td>* Smell and taste the water. How does it compare with the water at home? [PS/HS/G/2]</td>
<td>* Look for animal spoor around the pan. Try and identify them with the aid of the table. [PS/HS/B/5]</td>
<td>* How does the soil differ in colour and texture from the soil on the rim of the crater? [PS/HS/G/5]</td>
</tr>
<tr>
<td></td>
<td>* What does salt get used for? [PS/HS/G/3]</td>
<td>* What organisms do you see in the water? [HS/PS/B/2]</td>
<td>* Look for bird footprints around the pan. Try and identify them with the aid of the table. [PS/HS/B/5]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Which industries make use of salt and how? [PS/HS/G/3]</td>
<td>* Measure the temperature of the water? [PS/HS/B/5]</td>
<td>* Record on the table which and how many birds you see at the water [PS/HS/B/5]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* What are the metal structures in the water? What were they used for? [PS/HS/G/3]</td>
<td>* Do a water quality test. [PS/HS/B/5]</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>* What is the temperature like at the salt pan? Compare it with the temperature on the rim of the crater? [PS/HS/G/2]</td>
<td>* Why do you think they drilled the two boreholes? [HS/G/2]</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* What can the water in the pan be used for? [HS/G/2]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Vegetation | | | | |
APPENDIX 10: LIST OF PEOPLE THAT GAVE INPUTS INTO TSWAING ENVIRONMENTAL EDUCATION ACTIVITIES

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Tel/Cel/Fax/Email</th>
</tr>
</thead>
</table>
| Callie Loubser      | Department of Further Teacher Education, Unisa, PO Box 392 Pretoria 0003 | T: 429 4614  
F: 429 3444  
E: loubscp@alpha.unisa.ac.za |
| Petro van Niekerk  | Vista University, Dept of Biological Sciences, P/b X634, Pretoria 0001  | T: 322 1303                        |
| Anna Hugo           | Department of Primary School Teacher Education, Unisa, PO Box 392 Pretoria 0003 | T: 4294002  
F: 429 3444  
E: hugoaj@alpha.unisa.ac.za |
| Irma Horn           | Department of Primary School Teacher Education, Unisa, PO Box 392 Pretoria 0003 | T: 429 4381  
F: 429 3444  
E: hornih@alpha.unisa.ac.za |
| Marthie Bornman     | Department of Educational Studies, Unisa, PO Box 392 Pretoria 0003       | T: 429 4004  
F: 429 3444  
E: bornmgm@alpha.unisa.ac.za |
| Dietmar Vogl        | Tswaing Crater Museum, P.O Box 28088, Sunnyside, 0132                   | T: (01214) 987302  
F: Do  
E: nchl@nchl.co.za |
| Alison Nielson      | Transvaal Museum, P.O Box 413, Pretoria,0001                           | T: 322 7632  
F: 322 7939  
E: anelson@interlog.com |
| Liz Schaller        | SACTE, Private Bag x460, Pretoria 0001                                 | T: 422 8157  
F: 343 9893  
E: emjcschaller@sacte.ac.za |
| Carol Steenkamp     | Vista University Dept of Agricultural Sciences P/Bag X634, Pretoria 0001 | T: 322 1303  
F: 322 3243  
E: STKMP-CJ@acaleph.vista.ac.za |
| Elrina Whitlock     | Vista University Dept of Biological Sciences P/Bag X634, Pretoria 0001   | T: 322 1303  
F: 322 3243  
E: WTLCK-CE@acaleph.vista.ac.za |
<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Phone</th>
<th>Fax</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zola Vakaliza</td>
<td>Department of Secondary School Teacher Education, Unisa, PO Box 392 Pretoria 0003</td>
<td>T: 429 4788</td>
<td>F: 429 3444</td>
<td>E: <a href="mailto:vakalncg@alpha.unisa.ac.za">vakalncg@alpha.unisa.ac.za</a></td>
</tr>
<tr>
<td>Mark van Heerden</td>
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</tbody>
</table>
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Esther Masilela  Community member  

Diketedi Modise  Thulaganyo Middle School  P O Box 131  Winterveldt  0198  
01214-704047  

Leta Mahwanazi (Tswaing Planning Committee)  

Ester Moketsi (Chair person Tswaeng Forum)  

Solly Kotu (Soshanguve school, 01214-7931002)  

Salome Mafa (Batiseng Primary School, Soshanguve, 01214-7931337)  

Robert Molapo (Junior Secondary School, P.O Box 2753, Rosslyn, 0200, 012-5493060)  

Alet Boshoff (National Cultural History Museum, 341 1320)  

Robert de Jong (National Cultural History Museum)  

Kobus Basson (National Cultural History Museum)  

Activity b:  
Also give them a contour map of the area and ask them to draw any streams or possible streams they come across to show the presumed direction of flow  

When you have finished the page you arrive at the exits.
APPENDIX 11: EXAMPLE FROM RUSTENBURG TRAIL BROCHURE

6.4 Trail description

Ice-breaking session on arrival:

When you arrive at the Kudu hut, inspect the area around the hut and concentrate on the following:

* Would you say the hut is situated on a ridge, in a valley or gulley? Why do you say this?
* Take a hand full of soil and feel what it is like, is it fine or coarse?
* Do you hear or see any birds and animals around the hut? Can you identify them?
* What is the vegetation like around the hut? Are there lots of grass, shrubs or trees?
* Describe the feature in front of the hut. What do you think caused this? How can it be stabilised?
* What do you notice about the rocks to the right of the kloof above the hut?

After allowing the individuals to investigate and experience the area an officer from the reserve can welcome them to the reserve later the evening. The officer can give a very brief information session on the aspects covered by the above ice-breaking questions.

DAY ONE: Suggested departure time - 07:00

Activity a:

* Ask the individuals to write down a description of the types of vegetation they walk through and what animals they see in each area.

Activity b:

* Also give them a contour map of the trail and ask them to fill in any streams or possible streams they come across. Indicate the presumed direction of flow.

When you have climbed the ridge you arrive at the crest.
Activity c:

* Pick up some soil and feel it, how does it compare to that at the hut?
* Describe the vegetation and rock formations you see when you have reach the crest.
* What is the air temperature like here?

The soil here is shallow and gravelly with limited plant cover because soil of this kind retains very little moisture. This lack of water and food limits the animal life here.

The route continues down towards the tar road. After crossing the road the route descends downward along the crest towards the valley below.

Activity d:

* How deep is the soil here?
* How much water do you think the plants need?
* Compare the soil, vegetation, rock formations and air temperature here with that of the kloof.

The trail climbs along the crest you will come across some "Boer War skanse".

Activity e:

* Draw the lay out of these trenches.
* Why do you think they are located here?
* What do you think their purpose was?
7.2 Baviaanskrans worksheet

Ice-breaking session on arrival

Would you say the hut is situated on a ridge, in a valley or gulley? Why do you say this?

Take a hand full of soil and feel what it is like, is it fine or coarse?

Do you hear or see any birds and animals around the hut? Can you identify them?

What is the vegetation like around the hut? Are there lots of grass, shrubs or trees?

Describe the feature in front of the hut. What do you think caused this? How can it be stabilised?

What do you notice about the rocks to the right of the kloof above the hut?

DAY ONE:

Activity a:

Ask the individuals to write down a description of the types of vegetation they walk through and what animals they see in each area.

Activity b:

Also give them a contour map of the trail and ask them to fill in any streams or possible streams they come across. Indicate the presumed direction of flow.
Activity c:

What do you note about the rocks, vegetation and temperature in the kloof?

Complete the following table over the next two days.

<table>
<thead>
<tr>
<th>PLACE</th>
<th>TIME</th>
<th>TEMPERATURE</th>
<th>VEGETATION</th>
<th>ALTITUDE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kudu hut</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kloof</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eco-hut</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waterfall</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tar road</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What is the soil like in the kloof?
APPENDIX 12: ECO-HUT AT RUSTENBURG
APPENDIX 13: EXAMPLES OF TSWAING ENVIRONMENTAL EDUCATION ACTIVITIES - PHASE 2

Activity 13

Problem: Station II

Task: Making soil

Teaching area: Social Sciences, Natural sciences, Technology

Duration of activity: 40 minutes

Materials needed: Two pieces of soft paper measuring 300mm x 150mm, 5 pieces of different soil, 7 - 8 litres of water

Methodology:

1. Mix the soil with water. The amount of water is determined according to the type of soil. The soil must be brown, clayey, and contain nutrients that are essential for plant growth.
2. Put some soil in a bag and let it dry. After 10 minutes, measure the soil with a cup of sand or other measuring instrument. The amount of water, as mentioned in step 1, must be added to make the soil

Background:

It is important that young children understand the importance of a healthy soil. Soil is one such a resource which is essential for plant growth. Soil contains nutrients, water, and other essential minerals that plants need to grow. It is also important to teach children how to conserve soil and where the soil comes from. This activity provides an introduction to children on how different soils are used. The activity can be extended to include more types of soil by growing different plants.
Activity 13

Stations: Station F

Topic: Making soil

Learning area: Human and Social Sciences, Natural sciences, Technology

Outcomes:

- To indicate how weathering leads to soil formation.
- To show different types of soils at different stages of weathering.
- To teach learners some calculating skills.

Skills: To read time, measuring by using a teaspoon

Duration of activity: 40 minutes

Materials needed: Two pieces of soft stone, a newspaper, a spoon or small measuring instrument, a self-made clock, bottles with pebbles, different soil types.

Pre visit activity: Let the children make a clock by using a paper plate or by cutting out a round piece of cardboard. Insert clock arms by cutting them out and fastening them with a paper clip.

Background

It is important that young children understand how important natural resources are. Soil is one such a resource which supplies plants a place to grow, contain minerals, etc. It, however, takes a long time to be formed. This activity will show how soil is formed and how long it takes to be formed. It will also be shown what happened at the crater and where the rock pebbles come from. It will be shown how different soil types look like. This activity can be extended in the class room by growing seedlings.

Methodology:

DO IT!

1. Let children rub rocks together for exactly 10 minutes. The rocks must be rubbed vigorously. Collect the dust on a piece of newspaper. After 10 minutes measure the sand made with a tea spoon or other measuring instrument. The amount of sand made in 10 minutes was: ______________ level teaspoons.

2. A few calculations can be made according to the level of the learners. Ask the learners: if it took 10 minutes to make the amount of sand mentioned in 2 above, how long will it take to make 100 cubic
centimetres (100 teaspoons).

4. For a bit older children, a medium sized tree needs at least one cubic metre of soil in which to grow. A cubic metre contains 1 000 000 cubic centimetres or 1 000 000 level teaspoons. How long will it take to make enough soil for a tree? Show your calculations.

5. In what ways can soil be formed? Bearing in mind that rocks are not rubbed together in nature as continuously as in our activity - would you say that soil is formed quickly, slowly or very slowly.

6. Tell us why you think soil is an important resource for us.

**Post visit activity**

1. When back in the class room, learners can use old plastic margarine containers and make holes in the bottom of the containers. Add some small stones and fill them with some of the soil that was made in the activity. Also make a container with some other soil (Other interesting containers can be used such as egg shells, hollowed out potatoes, etc.)

2. The learners plant a seedling in each container, press soil around it and water. (Seeds can also be used)

3. Learners label the containers with their names and the type of plant they are growing.

4. Learners make up a note book on their plants or on a piece of paper left beside the container. Learners note the daily growths of their seedlings, measuring changes in height, new leaves, flowers, etc.

5. After a while the plants can be presented to family members, the Tswaing crater, the local library, a park, the school, etc.

Why do the seedlings not grow well in the freshly made soil?

*Adapted from 'We care primary'*

**Example of table to use for observation**

<table>
<thead>
<tr>
<th>Date</th>
<th>Growth observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday 11 March</td>
<td>Seedling grows 1 cm. 1 new leave formed</td>
</tr>
<tr>
<td>Tuesday 12 March</td>
<td>Seedling grows 0.7 cm. No new leaves</td>
</tr>
<tr>
<td>Thursday 14 March</td>
<td>Seedling grows 1.4 cm. Two new leaves formed</td>
</tr>
<tr>
<td>Etc</td>
<td>Etc</td>
</tr>
</tbody>
</table>

The table can only be used by children that can read and write.
APPENDIX 14: DISCUSSIONS WITH TWO OF THE COMMUNITY MEMBERS OF TSWAING

Discussion with Ester from KromkUIL at Tswaing on 19/01/1998

* Pedi's, Sotho's and Tswana men lived at the mine in compounds while
  the families lived at Kromkui. The cattle was also kept at Kromkui.
* The people worked at the mine in day and night shifts to get money to
  send the children to school. It was only at a later stage that believe
  aroused that the spirits were not allowed to be disturbed at night.
* The mine provided an opportunity to make a living.
* Young girls helped to pack the sacks.
* Pyramid was the closest station to the factory and the salt was carted
  by oxwagen (Nguni) and bokwagen.
* Traditional way of mining stopped when the factory started.
* The salt was payment for the packers/helpers. They sold it again in
  solid pieces. The salt was packed in hesiene bags.
* Mr du Toit was the plant master
* Church and school gone
* There is a storey that the meteorite came after the factory.
* Lebalangwe: stayed there, local mine, clay soil, made dishes from the
  clay soil.
* The lime bags are the last stop before the salt was packed. Hard canvas was placed
  on top of the bags. The lime was used to disinfect the salt and keep it dry and
  loose/fresh. Ox wagens were used to transport the salt.
* The morula fruit was boiled and used for beer. This was sold again.
* Morokulu tree is scarce in the veld now. They used it for jam and did
  not need sugar to sweeten it. Was like youngberries.
* At the factory the salt was dried in the drying pans.
Discussion with Mr Tiki Motau (born in 1918) at Tswaing on 19/01/1998

* The soda was boiled at night and was dangerous
* The factory closed in 1961
* The workers got paid 6 sjielings a month
* The first group of salt miners were unsuccessful
* Lime was added into the soda to get it white but it stayed brown.
* A diesel machine was used to mix it for 1 hour.
* The Middleburg farmers bought a lot of salt for their cattle and goats
* The coal used came from ABC coal company in Pretoria West. The coal was used twice therefore the ash is very fine. If the ash heaps are dug up some articles used in the factory might be found.