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Njia za Utafiti,
Field Techniques (EUBS)

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East Usambara Conservation Area Management Programme

Technical Paper 55

Utangulizi juu ya Utafiti wa Bayoanuwai Usambara Mashariki (EUBS): Njia za Utafiti

An Introduction to East Usambara Biodiversity Surveys (EUBS) Field Techniques

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East Usambara Conservation Area Management Programme (EUCAMP)
The East Usambara rain forests are one of the most valuable conservation areas in Africa. Several plant and animal species are found only in the East Usambara mountains. The rain forests secure the water supply of 200,000 people and the local people in the mountains depend on these forests. The East Usambara Conservation Area Management Programme has established the Amani Nature Reserve and aims; at protecting water sources; establishing and protecting forest reserves; sustaining villager's benefits from the forest. The programme is implemented by the Forestry and Beekeeping Division of the Ministry of Natural Resources and Tourism with financial support from the Government of Finland, and implementation support from Indufor / Metsähallitus Group. To monitor the impact of the project, both baseline biodiversity assessments and development of a monitoring system are needed. The present activity is aimed at establishing baseline information on biological diversity in selected East Usambara forests.

The University of Dar es Salaam (UDSM)
The University of Dar es Salaam was established in July 1970 as a centre for learning and research in the arts and the physical, natural, earth, marine, medical and human sciences. The University is surveying and mapping the flora and fauna of Tanzania and is conducting research into the maintenance and improvement of the environment and the sustainable exploitation of Tanzania's natural resources.

The Society for Environmental Exploration (SEE)
The Society is a non-profit making company limited by guarantee and was formed in 1989. The Society's objectives are to advance field research into environmental issues and implement practical projects contributing to the conservation of natural resources. Projects organised by The Society are joint initiatives developed in collaboration with national research agencies in co-operating countries.

Frontier Tanzania Forest Research Programme (FT FRP)
The Society for Environmental Exploration and the University of Dar es Salaam have been conducting collaborative research into environmental issues since July 1989 under the title of Frontier Tanzania, of which one component is the Frontier Tanzania Forest Research Programme (FT FRP). Since July 1994, the FT FRP has been working in the forests of the East Usambara mountains in collaboration with the East Usambara Conservation Area Management Programme (EUCAMP). This survey of selected forests collects baseline biodiversity data and assists the EUCAMP in the management of the East Usambara forests.

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This document was written during the biodiversity survey of Nilo forest reserve and serves as a hands on document for practical use for forest officers for future survey and monitoring activities. The aim was to present effective, simple explanations of the techniques used during the biodiversity surveys. For more in depth information with regard to the survey methodologies, refer to SEE (1998).

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Utangulizi juu ya Utafiti wa Bayoanuwai Usambara Mashariki (EUBS): Njia za Utafiti

Yaliyomo

1.0 MALENGO

- Kutoa taarifa kwa ufupi kuhusu njia za utafiti, mbinu na mpango wa kazi wa Utafiti wa Bayoanuwai Usambara Mashariki (EUBS) kwa Maafisa Misitu wa EUCAMP.
- Kusaidia mafuzo uwandani.
- Kusaidia kama Rejea kwa matumizi ya baadae.

2.0 UTANGULIZI

2.1 Kwa nini Misitu ya Usambara Mashariki ni muhimu sana?

Milima ya Usambara Mashariki inaunda mnyororo ujulikanao kama Safu ya Mashariki. Milima hii inatambaa pembezoni mwa pwani ya Afrika Mashariki kutoka Kusini mwa Kenya hadi Kusini mwa Tanzania. Misitu ya hali ya Usambara Mashariki ni moja ya kati ya maeneo ya hifadhi yenye thamani sana Afrika. Mimea na Wanyama kadhaa wanapatikana milima ya Usambara Mashariki pekee. Misitu hii ya hali inahakikisha upatikanaji wa maji kwa watu 200,000 na wenyeji wa milima hii wanategemea misitu hii.

Zaidi ya miaka mia moja ya udadisi wa kibayolojia na utafiti imeonyesha misitu ya Usambara Mashariki inamchanganyiko wa kipekee wa mimea na Wanyama, na hali kubwa ya upekee. Imeorodheshwa kuwa eneo tete la bayoanuwai (biodiversity hotspot) na kituo cha mchanganyiko mkubwa wa mimea. Misitu hii imefananishwa kwenye mlingano wa kiafrika na visiwa vya Galapagos katika misingi ya upekee wake na bayoanuwai (Rogers & Homewood, 1982; Howell, 1989). Inachukuliwa kuwa moja ya eneo muhimu katika Afrika (Tye, 1994). Kwa sasa, kiasi cha aina 2,800 za mimea zimekwisha rekodiwa kiasi ambacho inakisiwa zaidi ya robo ni ya kipekee (haipatikani pengine popote ila misitu hii){endemic} au karibia ya kipekee {near-endemic} (Iversen, 1991). Aina nyingi ziko katika hatari ya kutoweka (Rodgers, 1996).

Mbali na thamani ya bayoanuwai, misitu ya Usambara Mashariki ni muhimu kwa kutunza maji. Misitu hii inafanya kazi muhimu katika kuendeleza mzunguko wa maji (hydrological cycle) unaousaidia mto Sigi. Mto Sigi ni chanzo muhimu cha maji kwa jamii za wenyeji na eneo kubwa la Tanga Mjini. Uharibifu wa misitu hii utasababisha kuongezeka kwa mmomonyoko wa udongo na hasa kwa sehemu zenye mitelemko mikali. Mmomonyoko wa udongo utasababisha maji kusambaa bila mpango mzuri na hivyo kuharibu ubora wa maji kwa kujaa udongo (siltation).

Milima ya Usambara Mashariki kwa mantiki ni ‘visiwa’ (Lovett, 1989). Kumekuwa na misitu ya asili katika eneo hili kwa maelfu, kama si mamilioni, ya miaka. Misitu hii imekuwa katika mbinyo wa kinyonyaji wa binadamu, kwa uchache, kwa miaka 2,000 (Schmidt, 1989). Hadi hivi karibuni, hasa hadi miaka 50 iliyopita, (Kikula, 1989), mbinyo huu umekuwa endelevu. Ingawa, ongezeko la haraka la watu katika eneo hili linaongeza mbinyo kwa misitu ya asili iliyobakia, na hivyo kuwa tishio kwa kuwepo kwake (Collar & Stuart, 1987). Misitu ya Usambara inabeba aina nyingi ambazo kijiografia zimetenganishwa kutoka ndugu zao wa karibu kwa muda mrefu. Vilevile inatoa hifadhi ya kwa mimea na Wanyama ambayo hapo zamani ilikuwa imetapakaa kila mahali lakini

imetoweka katika maeneo mengi (Iversen, 1991). Uhifadhi na utunzaji wa eneo hili pekee la bayoanuwai ni lazima upewe umuhimu mkubwa.

2.2 Programu Ya Utafiti Misitu Frontier Tanzania (FT FRP)

Jumuiya ya Uvumbuzi wa Mazingira na Chuo Kikuu cha Dar es Salaam zimekuwa zikiendesha utafiti kwa pamoja juu ya masuala ya mazingira tangu Julai 1989 chini ya kichwa cha Programu ya Utafiti Misitu Frontier Tanzania (***Frontier Tanzania Forest Research Programme) (FT FRP)***. Tangu Julai 1994, FT FRP imekuwa ikifanya kazi katika misitu ya Milima ya Usambara Mashariki ikishirikiana na Programu ya Uendelezaji Misitu Usambara Mashariki (EUCAMP). Utafiti wa maeneo yaliyochaguliwa unawezesha ukusanyaji wa taarifa za msingi za bayoanuwai na kusaidia EUCAMP katika uendelezaji wa misitu ya Usambara Mashariki.

2.3 Utafiti wa Bayoanuwai Usambara Mashariki

Ingawa kiasi cha kuridhisha cha taarifa za kibayolojia kutoka Usambara Mashariki zipo, nyingi kati yake zimelenga eneo la Amani pekee, na tafiti zilizopangiliwa ni chache. Ili kupata taarifa za kueleweka juu ya misitu, tafiti wa bayoanuwai zilianzishwa Julai 1995 zikisimamiwa na EUCAMP. Tafiti hizi zinaendeshwa na Frontier Tanzania, ushirikiano kati ya Chuo Kikuu cha Dar es Salaam na Jumuiya ya Uvumbuzi wa Mazingira, pamoja na EUCAMP, kama *Utafiti wa Bayoanuwai Usambara Mashariki.* Malengo makubwa ya utafiti huu ni:

- kutoa taarifa za msingi (systematic baseline information) juu ya thamani za kibayolojia za misitu tofauti kama msingi wa mipango ya maendeleo na ufuatiliaji wa muda mrefu.
- kutoa mafunzo katika mbinu za kibayolojia za ukusanyaji na kuweka rekodi (biological inventory techniques) kwa wafanyakazi wa EUCAMP.

Tafiti hizi zitatumika kuweka mipango ya uhifadhi kwa eneo hili lenye thamani.

Shughuli uwandani zimekuwa zikichukua kipindi cha wiki 10-12. Programu hii inahusisha wafanyakazi wa kudumu wa EUCAMP, Frontier, Chuo Kikuu cha Dar es Salaam, na wafanyakazi wa Taasisi ya Utafiti Misitu, vile vile mtandao wa kimataifa wa wataalamu. Wataalamu wa muda mfupi wa kujitolea wamekuwa pia wakichangia katika shughuli za uwandani kwa baadhi ya misitu ya hifadhi. Tafiti hizi tayari zimekwishagundua aina kadha wa kadha za mimea na Wanyama ambayo haikujulikana hapo kabla. Hii itaongeza mwamko wa upekee wa thamani ya uhifadhi wa misitu ya Usambara Mashariki. EUCAMP pia imeagiza undelezwaji wa taarifa (database) za bayoanuwai. Taarifa zote zinazokusanywa katika tafiti hizi zinaingizwa katika hii *database* ambapo inawezesha taarifa kupatikana kwa mameneja misitu na wanasayansi wote wa ndani na wa nje.

2.4 Chuo Kikuu cha Dar es Salaam (UDSM)

Chuo Kikuu cha Dar es Salaam kilianzishwa Julai 1970 kama kituo cha mafunzo na utafiti katika sanaa na sayansi halisi, asili, dunia, bahari, tiba, na binadamu. Chuo Kikuu hiki kinafanya utafiti na kuchora ramani za wanyama na mimea ya Tanzania na kinaendesha utafiti katika kurekebisha na kuboresha mazingira na utumiaji endelevu wa maliasili za Tanzania.

2.5 Jumuiya ya Uvumbuzi wa Mazingira (SEE)

Jumuiya hii ni kampuni isiyo ya kibiashara ya Uingereza ililoanzishwa 1989. Malengo ya Jumuiya hii ni kukuza utafiti wa uwandani katika masuala ya mazingira na kutekeleza miradi iliyopo inayochangia katika uhifadhi wa maliasili. Miradi iliyoandaliwa na Jumuiya ni juhudi za pamoja zilizotokana na kushirikiana na vitengo vya utafiti vya kitaifa katika nchi zinazoshirikiana nayo.

3.0 MBINU NA MPANGO WA KAZI KWA UFUPI

3.1 Mimea

3.1.1 Kuweka *Mistari ya Utafiti* ni kukata njia zenye kusambaa kwa uwiano ndani ya msitu wa hifadhi.

Kwanini?:	**Kuwezesha kuwepo mlingano wa miraba ya mimea (vegetation plots) na kurahisisha mpangilio wa utafiti wa kinyesi na Uharibifu.**

Kwa vipi?:	**Kundi la watu 4 huunda timu ya kutafiti mstari.** **Mpango wa kazi unaelekeza jinsi timu hii itakavyofanya kazi**.

Mistari ya utafiti inaweza kukatwa ndani ya msitu toka mpaka hadi mpaka katika mpango wa Mashariki-magharibi, au Kasikazini-kusini, kutegemeana na ukubwa na umbo la msitu wenyewe. Mistari hii inatoa mirabafito ambayo itabeba kiasi kikubwa iwezekanavyo cha Miraba ya Mimea.

Kwa Msitu wa Hifadhi Nilo **MISTARI YA UTAFITI** imelala toka Mashariki kwenda Magharibi, MSTARI **WA KATI** ukipita Kasikazini-Kusini, (angalia mchoro 1).

MISTARI YA UTAFITI

- Urefu wa kila **MSTARI WA UTAFITI** unategemea umbali kati ya mipaka.
- **MISTARI YA UTAFITI** inatiwa alama ya vitambaa **2** VYEKUNDU kwa kila mita 50 na vitambaa **3** VYEKUNDU kila baada ya mita 450 (Miraba ya Mimea hutengwa hapa)

MISTARI YA KATI

Hii hutumika kama njia za kufikia **MISTARI YA UTAFITI**

- Urefu wa chini kabisa wa **MISTARI YA KATI** ni mita 900 na huungana na **MISTARI 2 YA UTAFITI**.
- **MISTARI YA KATI** inatambulishwa kwa vipande **2** vya nguo VYA NJANO kila baada ya mita 50 na **3** kila baada ya mita 900.

Utaratibu wa Kazi katika kukata MISTARI YA UTAFITI na MISTARI YA KATI

1. Mtu mmoja atafyeka mimea kwa panga, akipima umbali wa mita 50 kwa kamba. Atatia alama kila mita 50 kwa vitambaa **2** vilivyofungwa kwenye mmea. Katika kila mita 450 vitambaa **3** hufungwa. Urefu wa mistari ya utafiti huandikwa kwenye vitambaa hivi kwa kutumia kalamu itakayodumu.
2. Mtu wa pili atamwelekeza mtu wa mwanzo kwa *compass* kuhakikisha mstari unanyooka.
3. Mtu wa tatu atafunga kitambaa kimoja (kwa kadri kila baada ya mita 5) katika mimea ili kutambulisha njia.
4. Mtu wa nne atarekodi taarifa za ukataji mistari ya utafiti na kuhakiki kwa *compass* kwamba njia ni kama ilivyopangwa. Mwinuko wa ardhi na umbali toka usawa wa bahari wakati wa kuanza kwa Urefu wa mita 50 vitarekodiwa, na kila kitu muhimu mfano miamba, kilimo, njia, vijito, n.k., vitanakiriwa. Kutokana na vipimo vya mwinuko, Urefu mwingine waweza kuongezwa katika umbali wa mita 50. Mwinuko ukiwa mkali ongezeko la Urefu litakuwa kubwa pia. *Karatasi za Taarifa za Ukataji wa Mistari ya Utafiti* zinatoa maelekezo yote.

VIFAA VINAVYOTUMIKA – Kukata Mistari ya Utafiti

Panga, 3 *compasses, altimeter, clinometer*, Kamba m50, Vipande vya nguo VYEKUNDU au NJANO, Kalamu, Kitabu cha Kuandikia kisichopitisha maji na Penseli.

3.1.2. Miraba ya Mimea

Miti yenye DBH kubwa zaidi ya sm 10 (upenyo katika Urefu wa m 1.3) itapimwa, itatiwa alama na kutambuliwa.

Kwanini?: Miraba ya mimea hugawanywa kwa usawa katika eneo zima la msitu wa hifadhi kuhakikisha hakuna upendeleo katika uwakirishi, na pia kuwezesha kazi ya ufuatiliaji hapo baadaye kufanyika.

Kwa Vipi?: Kundi la watu 3-4 wataunda timu ya kutafiti mraba wa mimea.

MIRABA YA MIMEA ina eneo la wa m 20 x m 50.

Mpango wa kazi unaonyesha jinsi timu itakavyofanya kazi.

Mpango wa Kazi wa kuweka na kuanzisha MIRABA YA MIMEA

1. **MIRABA YA MIMEA** huwekwa kila m 450 katika **MISTARI YA UTAFITI** (mahali ambapo vitambaa **3** VYEKUNDU vimefungwa kwenye mimea).
2. Timu itaanzisha mraba kutoka kona ya KUSINI MASHARIKI kwa kutumia kamba mbili zenye m 50 na mbili zenye m 20. *Compasses* hutumika kuhakikisha kamba zinaumba mstatiri. Urefu wa m 20 mara zote huwa kasikazini.
3. Mtu mmoja atapima DBH ya miti ndani ya mraba, akitumia kamba ya kupimia DBH (calibrated DBH tape). Miti yenye DBH *sawa na* au *kubwa zaidi ya* **sm 10** ndiyo pekee itapimwa. (Wasiliana na wafanyakazi wa Frontier kuhusiana na vipimo vya DBH kwa miti yenye mashina mengi, yenye mizizi kwenye shina [buttressed] na iliyopinda).
4. Mtu wa pili atarekodi DBH, idadi ya miti na mahali ilipo katika mraba. Mwinuko, uelekeo (aspect), umbali toka usawa wa bahari, na mahitaji yake (standardised habitat notes) vitarekodiwa kwa kila mraba, tazama *Karatasi ya Taarifa za Mimea* kwa ufafanuzi zaidi.
5. Watu wawili waliobaki watafuata hali wakiandika **namba ya mraba** na **namba ya mti** upande wa kusini mwa kila mti uliotiwa rangi nyekundu (tazama Mchoro 2).
6. Kila mraba baadaye utapitiwa na mwanabayoanuwai (botanist).

- Kila mti uliopewa namba itatambuliwa aina yake na mwanabayoanuwai.
- Maotea {regeneration} (miti iliyo chini ya sm 10 za DBH) hutambuliwa aina yake pia katika eneo la m 3 x 3 na m 6 x 6 ndani ya mraba, na udongo huelezewa pia.
- *Karatasi ya Taarifa za Maotea* zinatoa maelezo ya ziada ya taarifa zinazorekodiwa.

VIFAA VINAVYOTUMIKA – Miraba ya Mimea

Kamba 2 x m 50, kamba 2 x m 20, Makopo 2 ya rangi, Brashi 2 za kupakia rangi, Kamba ya kupimia DBH, *compasses* 2, *clinometer, altimeter*, Kitabu cha Kuandikia kisichopitisha maji na Penseli.

3.1.3 Ukusanyaji wa Mimea Isiyotegemewa (Opportunistic Botanical Collection)

Ukusanyaji wa mitishamba, magugu (shrub) na sehemu za mti zisizo za kawaida.

Kwanini?: **Kutengeneza orodha ya aina ya mitishamba na magugu ili kuongezea kwenye taarifa za miti na kuhifadhi sampuli kwa matumizi katika Kituo cha Taifa cha Utafiti wa Mimea (the National Herbarium) Arusha na kwa Taasisi za Utafiti wa Mimea za Kimataifa zitakazohitaji.**

Kwa vipi?:

- **Sehemu za mimea zenye matunda na/au maua hukusanywa kwani zaweza Kusaidia utambuzi wa uhakika zaidi.**
- **Shughuli hii sana sana hufanywa na Albert Ntemi (EUCAMP) muda wote wa shughuli za uwandani..**
- **Sehemu za mimea hubinywa, kukaushwa, kupewa namba, maelezo na taarifa za makazi (habitat notes) za eneo la ukusanyaji hurekodiwa.**

VIFAA VINAVYOTUMIKA – Ukusanyaji wa mimea

***secaturs*, mifuko ya plastiki, kibinyio cha mimea, magazeti yasiyotumika, *blotters*, *corrugated dividers*, *altimeter*, kitabu cha kuandikia, penseli, ramani.**

3.1.4 Utafiti wa Kinyesi na Uharibifu

Utafiti huu hufanyika katika MISTARI YA UTAFITI.

Kwanini?:

- **KINYESI hukusanywa ili kutambua kuwepo kwa wanyama ambao hawaonekani kirahisi na ambao hutembea usiku, kama vile Paa, na kupata taarifa kuhusu wingi wao katika msitu wa hifadhi.**
- **UHARIBIFU hupimwa kupata vielelezo vya wingi wa mimea iliyovunwa na matatizo mengine ndani ya msitu yanayotokana na matumizi ya binadamu.**

Kwa vipi?: **Kundi la watu 4 huunda timu ya watafiti wa Kinyesi na Uharibifu.**
Utafiti hufanyika katika MISITARI YA UTAFITI
Mpango wa Kazi unaonyesha njisi timu hii inavyofanyakazi.

Mpango wa Kazi kwa UTAFITI WA KINYESI NA UHARIBIFU

- Utafiti hufanyika baada ya **MISTARI YA UTAFITI KUWEKWA.**
- Watu wawili, mmoja kila upande wa **MSTARI WA UTAFITI** huhesabu idadi ya miti iliyokatwa zamani na hivi karibuni, iliyo hai na iliyokufa kifo cha kawaida *{natural dead poles}* (miti ya kati ya sm 5 na sm 15 DBH) na mbao {*timber*} (miti mikubwa zaidi ya sm 15 DBH) katika m 5 za mstari wa utafiti.
- Mtu wa tatu atatafuta vinyesi na kukusanya sampuli zake.
- Mtu wa nne atarekodi taarifa kila m 50. Mbali na idadi ya miti (poles and timber), mtu huyu pia atarekodi vitu muhimu kama dalili za moto, mitego ya wanyama, kilimo, njia, mizigo ya kuni.
- *Karatasi ya Data za Uharibifu* na *Data za Kinyesi* zinatoa maelezo zaidi.

VIFAA VINAVYOTUMIKA – Utafiti wa Kinyesi na Uharibifu

Panga, makopo (ya kukusanyia kinyesi), kipimo cha DBH, kamba ya kupimia m 10, kitabu cha kuandikia kisichopitisha maji, penseli.

3.2 Kazi za Kizoolojia

Kwanini?

- **Lengo la kazi hii ya utafiti ni kutengeneza orodha ya aina mbalimbali za mamalia, amphibia, reptilia na makundi yaliyochaguliwa ya wanyama wasio na uti wa mgongo (invertebrates) ndani ya hifadhi.**
- Baadhi ya wanyama walichaguliwa kwa utafiti. Hawa ni *panya* (*rodents, shrews),* ***popo, vyura, nyoka, mijusi, vipepeo, majongoo, konokono na ndege.*** **Kuna sababu kuu 4 za kuchagua wanyama hawa kwa utafiti:**

1. **Kuna wataalamu kitaifa na kimataifa walipenda kutambua wanyama hawa.**
2. **Wanyama hawa wanauwezekano wa kutafitiwa vizuri katika muda uliowekwa.**
3. **Tayari kuna kazi zilizokwisha kuandikwa kuhusu wanyama hawa ambazo zinaweza Kusaidia utambuzi uwandani.**
4. **Hata hivyo ni taarifa ndogo sana zimeshaandikwa kuhusiana na ikolojia ya wanyama hawa na nyingi hazifahamiki. Hivyo, katika kukusanyia sampuli na data za ikolojia, taarifa za kisayansi zaweza kuongezeka na hivyo Kusaidia katika utunzaji wa misitu ya hifadhi.**

Kwa vipi?
Kundi hilo la wanyama hapo juu kwa ujumla hutafitiwa katika maeneo ya mitego kwa kutumia njia mbalimbali na kwa kutumia Uchunguzi wa Vitu Visivyotegemewa (opportunistic observations).

VIFAA VINAVYOTUMIKA – Kazi za Kizoolojia
Mitego 100 ya Sherman, Mitego 33 ya ndoo, m 9, m 6, m 3 nyavu za popo, vipepeo, Mitego juu ya miti (canopy traps), vyandarua vya vipepeo.

3.2.1. Maeneo ya Mitego

Muda Uliowekwa: Siku 10 za kutega usiku
Sehemu: Makazi wakirishi katika hifadhi.
Njia: Njia tofauti hutumika kwa wanyama tofauti (Tazama chini kwa maelezo)

3.2.1.1 Mtego wa Sherman (Sherman Live Trapping)

Panya hukamatwa kwa kutumia mtego wa Sherman, ambao hauwadhuru wanyama. Mitego 100 hutegwa katika mistari mitatu ikizunguka mstari wa mitego ya ndoo (tazama chini). Mitego 33 huwekwa m 2 kutoka mmoja hadi mwingine kuzunguka mstari wa shimo. Mitego huwekwa kila jioni na kuangaliwa kila asubuhi ya siku inayofuata. Kila mamalia inayokamatwa hupimwa uzito, urefu na taarifa za makazi hurekodiwa. Kwa habari zaidi tazama *Karatasi ya Data za Sampuli.*

3.2.1.2 Mtego wa Ndoo (Bucket pitfall trapping)

Mtego wa ndoo unahusisha misitari mitatu yenye ndoo 11 za plastiki zenye ukubwa wa lita 20 kila moja ambazo huchimbiwa ardhini (mashimo huchimbwa na ndoo kuwekwa ndani yake). Ndoo hizi huwekwa kama m 5 kutoka kila moja. Kipande cha plastiki hulazwa ardhini katika mstari mnyoofu ikipita katikati ya kila ndoo. Wanyama huelekezwa kufuata plastiki hiyo hadi kwenda kudumbukia kwenye ndoo. Panya (shozwe), vyura, na nyoka kwa ujumla hukamatwa kwenye ndoo. *Karatasi ya Data za Sampuli* zinatoa taarifa zilizorekodiwa za wakati mnyama alipokamatwa.

3.2.1.3 Utegaji wa Popo kwa Nyavu (Bat netting)

Nyavu (mist nets) hutumika kuanzia machweo hadi mawio. Nyavu huwekwa karibu na wanapolala popo na sehemu wanazopita warukapo (flight "corridors"), kama vile njiani na kwenye vijito. Utegaji huu hufanyika katika maeneo yote ya kutegea (trap site) na sehemu nyingine zifaazo, kama muda unavyoruhusu. Kila popo anayekamatwa hupimwa uzito na Urefu katika eneo la mitego. *Karatasi ya Data za Sampuli* zinatoa taarifa zilizorekodiwa za wakati mnyama alipokamatwa.

3.2.1.4 Vipepeo

Vipepeo hukusanywa kwa kutumia mitego ya juu ya miti (canopy traps) na vyandarua (sweep nets). Mitego ya juu ya miti huwekwa katika Urefu tofauti katika kila eneo tofauti la mitego. Ndizi iliyooza hutumika kama chambo. Mitego ilikaguliwa kila mchana. Mitego huwekwa kwa siku 10 katika kila eneo la mitego. Vipepeo hukamatwa kwa kutumia vyandarua (sweep nets) kwa saa moja kati ya saa 6 na 8 mchana kwa kila siku kumi za Utegaji.

3.2.1.5 Konokono na Majongoo (Molluscs & Millipedes)

Maeneo matatu yenye makazi madogo madogo wakilishi huchaguliwa katika kila eneo la utegaji. Katika kila eneo mraba wa m 1 x m 1 huanzishwa kutafiti Konokono, na m 3 x m 3 kwa majongoo. Katika kila mraba majani yaliyodondoka na udongo sm 3 za mwanzo huchunguzwa vizuri kupata Konokono au majongoo. Kila Sampuli kukusanywa.

3.2.2 Uchunguzi wa Vitu Visivyotegemewa (opportunistic Observations)

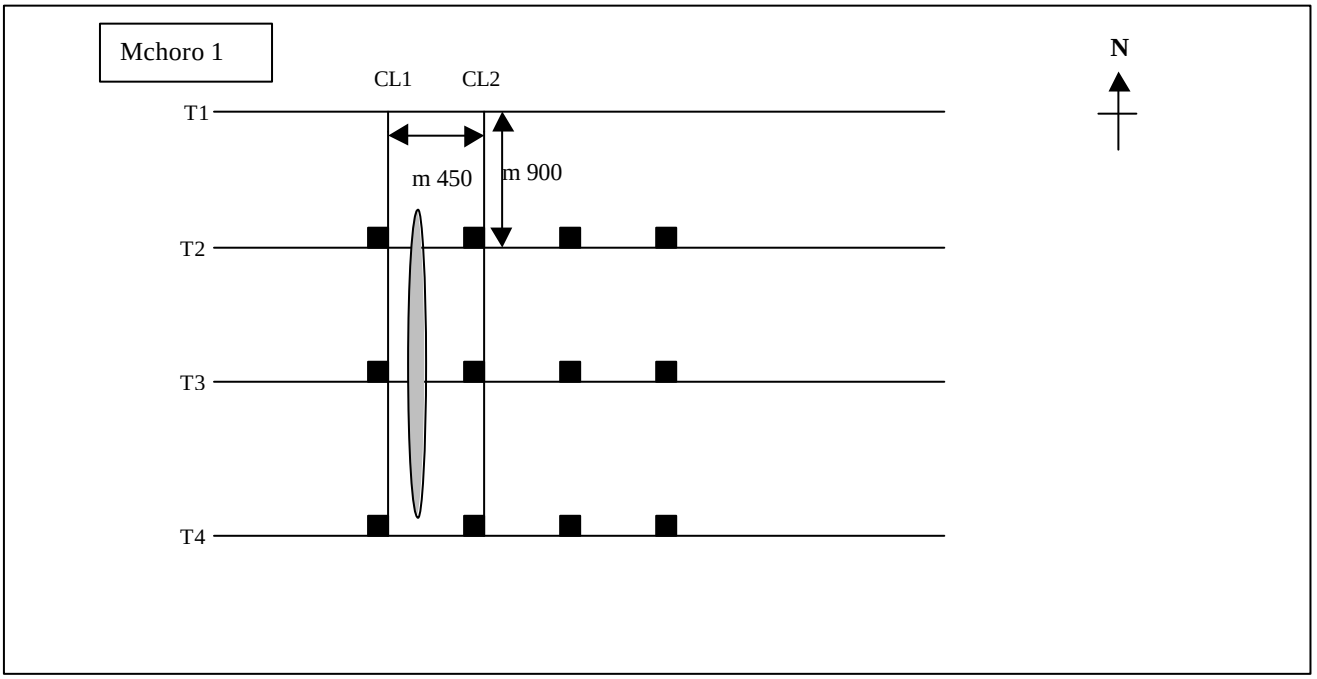
Uchunguzi wa wanyama wengine, hasa jamii ya nyani, hurekodiwa wakati wote wa utafiti. Ndege huchunguzwa katika hali ya kawaida kwani huwa hawakusanywi kwa utaratibu. Ukamataji wa reptilia na amphibia zisizotegemewa (opportunistic) huweza kufanywa kwa mkono, au kwa kutumia mti inapobidi. Baada ya kipindi cha mvua, makazi halisi ya amphibia hutafutwa kwa ajili ya uchaguzi katika utafiti. Vipepeo aidha hukusanywa katika hali ya kawaida mbali na ifanyikavyo kwenye maeneo ya mitego

4.0 MICHORO

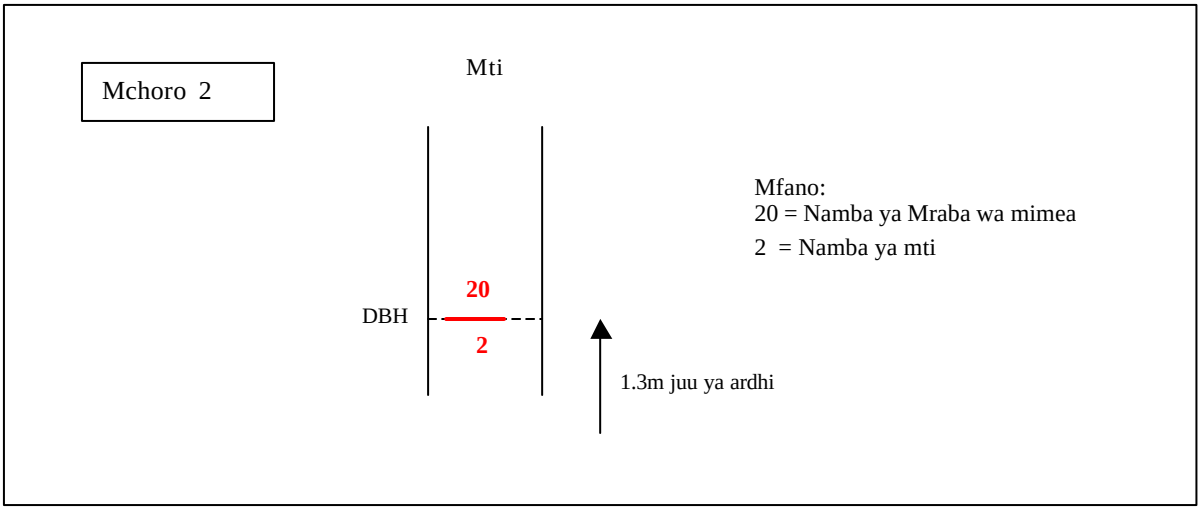
Mchoro 1: Unaonyesha njia ya kuweka mistari ya utafiti ambapo

T1=Mstari wa utafiti 1,. CL1=Mstari wa kati 1, = Eneo la mraba wa mimea

= Mwinuko mkali usiofikika.



Mchoro 2. Mchoro wenye upenyo usawa wa kifua (DBH) wa mti (>sm 10 DBH) na Utaratibu wa kutia rangi. Namba ya mraba (mf. 20) huandikwa juu ya namba ya mti (mf. 2), na mstari kati yake kuonyesha wapi DBH ilipimwa.



5.0 VIFAA VINAVYOTAKIWA

Maafisa wa EUCAMP wanatakiwa kuleta vitu vifuatavyo wakati wa kushiriki katika EUBS:

1. Buti imara za kutembelea
2. Chupa ya maji
3. Nguo za kutia joto na zenye kuzuia maji.
4. Kitabu (Note book) na kalamu
5. Begi la kubebea Vifaa binafsi.

6.0 REJEA

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7.0 MUHIMU

Kwa habari zaidi kuhusiana na Malengo na mbinu za utafiti za EUBS Rejea katika Hadidu za Rejea za EUBS, mtiririko wa Majarida ya Kitaalamu ya EUCAMP na Mbinu za Utafiti za SEE 'Za kale na za sasa'.

Kwa habari zaidi kuhusu Milima ya Usambara Mashariki na Safu ya Milima ya Mashariki pitia vitabu vya Rejea hapo juu na pia makala za kiufundi za EUCAMP, na hasa kutoka Utafiti wa Bayoanuwai Misitu ya Hifadhi, makala namba 30 nakuendelea.

8.0 MAWASILIANO

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Mratibu wa Bayoanuwai:	Mr. Raymond Killenga
Mratibu wa Bayoanuwai / mwanabayoanuwai:	Mr. Albert Ntemi

AN INTRODUCTION TO EAST USAMBARA BIODIVERSITY SURVEYS (EUBS), FIELD TECHNIQUES

Contents

1.0 AIMS

- To provide summary information with regard to field techniques, methodologies and working procedures of the East Usambara Biodiversity Survey (EUBS) for EUCAMP Forestry Officers.
- To support field training.
- To provide as a reference for the future.

2.0 INTRODUCTION

2.1 Why are the East Usambara Forests so important?

The East Usambara mountains form part of a chain known as the Eastern Arc. These mountains stretch down the coast of East Africa from southern Kenya to southern Tanzania. The East Usambara rainforests are one of the most valuable conservation areas in Africa. Several plant and animals are found only in the East Usambara mountains. The rainforests secure the water supply of 200,000 people and the local people in the mountains depend on these forests.

More than one hundred years of biological interest and research has shown that East Usambara forests have a unique diversity of flora and fauna, and an exceptionally high degree of endemism. They are globally listed as a biodiversity hotspot and centre of plant diversity. The forests have been likened to the African equivalent of the Galapagos Islands in terms of their endemism and biodiversity (Rogers & Homewood, 1982; Howell, 1989). They are considered to be one of the most important forest blocks in Africa (Tye, 1994). Currently, around 2,800 taxa of plants have been recorded of which it is suggested that over one quarter are endemic or near-endemic (Iversen, 1991). Many species are threatened (Rodgers, 1996).

In addition to the biodiversity value, the East Usambara forests are essential for the conservation of water resources. The forests play an important role in maintaining the hydrological cycle which feeds the Sigi river. The Sigi river is a vital water source for local communities and the large coastal town of Tanga. Deforestation in the area will lead to increased soil erosion particularly from the steeper slopes. Soil erosion is liable to result in more irregular run off and will deteriorate water quality due to siltation.

The East Usambaras are essentially forest 'islands' (Lovett, 1989). There has been natural forest in the area for thousands, if not millions, of years. These forests have been under continuous exploitative human pressure for at least 2,000 years (Schmidt, 1989). Until recently, especially until the past 50 years, (Kikula, 1989), this pressure has been sustainable. However, rapid human population growth in the area is increasing pressure on the remaining natural forest, and represents the main threat to their survival (Collar & Stuart, 1987). The Usambaras harbour many species which have been geographically separated from their closest relatives for long periods. They also serve as a refuge for formerly widespread flora and fauna that have become extinct over much of their former area (Iversen, 1991). The conservation and preservation of this unique area of biodiversity should be given high priority.

2.2 Frontier Tanzania Forest Research Programme (FT FRP)

The Society for Environmental Exploration and the University of Dar es Salaam have been conducting collaborative research into environmental issues since July 1989 under the title of the ***Frontier Tanzania Forest Research Programme (FT FRP)***. Since July 1994, the FT FRP has been working in the forests of the East Usambara mountains in collaboration with the East Usambara Catchment Area Management Programme (EUCAMP). The survey of selected forest reserves enables the collection of baseline biodiversity data and assists the EUCAMP in the management of the East Usambara forests.

2.3 East Usambara Biodiversity Surveys

Although a considerable amount of biological information exists from the East Usambaras much of this is restricted to the Amani area, and systematic surveys are few. In order to get more comprehensive information on the forests, biodiversity surveys were initiated and contracted by EUCAMP in July 1995. The surveys are conducted by Frontier Tanzania, a joint venture between the University of Dar es Salaam and the Society for Environmental Exploration, together with EUCAMP, as the *East Usambara Biodiversity Surveys*. The main aim of the surveys are:

- to provide systematic baseline information on the biological values of different forests as a basis for management planning and long-term monitoring
- to provide training in biological inventory techniques for EUCAMP staff.

The surveys will be used in setting conservation priorities for this valuable area.
The field work has been carried out over 10-12 week field phases. The programme involves, permanent EUCAMP, Frontier, University of Dar es Salaam, and Tanzania Forestry Research Institute staff, as well as an international network of taxonomists and other experts. Short term expatriate volunteers have also contributed to field work within some forest reserves. The surveys have already resulted in the discovery of several previously unknown taxa. This will further raise awareness of the unique conservation values of the East Usambaras. EUCAMP has also commissioned the development of a biodiversity database. All data collected during the surveys is entered in this database which allows information to be available to forest managers and scientists, both locally and internationally.

2.4 The University of Dar es Salaam (UDSM)

The University of Dar es Salaam was established in July 1970 as a centre for learning and research in the arts and the physical, natural, earth, marine, medical and human sciences. The University is surveying and mapping the flora and fauna of Tanzania and is conducting research into the maintenance and improvement of the environment and the sustainable exploitation of Tanzania's natural resources.

2.5 The Society for Environmental Exploration (SEE)

The Society is a non-profit making UK based company limited by guarantee and was formed in 1989. The Society's objectives are to advance field research into environmental issues and implement practical projects contributing to the conservation of natural resources. Projects organised by The Society are joint initiatives developed in collaboration with national research agencies in co-operating countries.

3.0 SUMMARISED METHODOLOGIES AND WORKING PROCEDURES

3.1 Vegetation

3.1.1 *Transecting* is the cutting of evenly distributed (systematic) paths through the forest reserve.

Why?:	**To enable the even distribution (systematic positioning) of vegetation plots and provide the framework for the disturbance and dung surveys.**

How?:	**A group of 4 people make up a transecting team.** **The Working Procedure outlines how the team works.**

Transect lines can be cut across the forest reserve from border to border in an East-West or North-South direction, depending upon the size and shape of the forest reserve. They provide a grid that will contain the maximum number of vegetation plots possible.

In the case of Nilo Forest Reserve **TRANSECT LINES** run East-West with **CENTRAL LINES** running North-South, (see Diagram 1).

TRANSECT LINES

- The length of each **TRANSECT LINE** is dependent upon the distance between the borders.
- **TRANSECT LINES** are marked with **2** RED tags every 50m and **3** RED tags every 450m (the vegetation plots are demarcated at this point)

CENTRAL LINES

- These are used as access routes to the **TRANSECT LINES**
- The minimum length of a **CENTRAL LINE** is 900m and will connect 2 **TRANSECT LINES**.
- **CENTRAL LINES** are marked with **2** YELLOW tags every 50m and **3** YELLOW tags ever 900m.

Working Procedure for cutting TRANSECT LINES and CENTRAL LINES

5. One person slashes vegetation with a panga, measuring the distance with a 50m rope. He/she marks every 50m with **2** tags which are tied to the vegetation. At every 450m, **3** tags are tied. Transect lengths are written on the tags in permanent pen.
6. A second person directs the person in front with a compass to maintain a straight line.
7. A third person ties single tags (generally every 5 m) to vegetation to mark the route.
8. A fourth person, records the transecting information and checks with a compass that the route is accurate. The slope and altitude at the starting point of the 50m length is recorded and any significant feature such as rock outcrops, cultivation, paths, streams etc. noted. From the slope measurement, additional length may be added to the 50m distance. The stepper the slope the greater the additional meterage (ongeza). The *Transecting Data Sheets* provide the details.

EQUIPMENT USED - Transecting

Panga, 3 compasses, altimeter, clinometer, 50m rope, RED or YELLOW tags, marker pen, water proof note book and pencil.

3.1.2. Vegetation Plots

Trees with a DBH greater than 10cm (diameter at breast height – 1.3m) are measured, marked and identified.

Why?:	**Vegetation plots are evenly (systematically) positioned throughout the forest reserve to enable a non-biased representation of the forest reserve and to allow future monitoring work to be carried out.**

How?:	**A group of 3-4 people make up a Vegetation Plot team.** **VEGETATION PLOTS are 20m x 50m in size.** **The Working Procedure outlines how the team works.**

Working Procedure for positioning and establishing VEGETATION PLOTS

7. **VEGETATION PLOTS** are positioned every 450m along the **TRANSECT LINES** (where there are **3** RED tags tied to the vegetation).
8. The team establishes the plot from the SOUTH EAST corner by using two 50m ropes and two 20m ropes. Compasses are used to ensure ropes form a rectangle. The 20m length is always to the North.
9. One person measures the DBH of the trees within the plot, using a calibrated DBH tape. Only trees with a DBH *equal to* or *greater than* **10cm** are measured. (Refer to Frontier staff concerning DBH measurement of multi-stemmed, buttressed and leaning trees).
10. A second person records the DBH, tree number and the position of the tree within the plot. Slope, aspect, altitude and standardised habitat notes are recorded at each plot, see *Vegetation Data Sheets* for the details.
11. The two remaining people follow and paint the **plot number** and **tree number** on the south-side of each tree with red paint (see Diagram 2).
12. Each vegetation plot is later visited by a botanist.

- Every numbered tree is identified to species by the botanist.
- Regeneration (trees less than 10cm DBH) are also identified to species level in 3 x 3m and 6 x 6m plots and the soil is described.
- The *Regeneration Data Sheets* provide details of information recorded.

EQUIPMENT USED – Vegetation Plots

2 x 50m rope, 2 x 20m rope, 2 x small pots of paint, 2 x paint brushes, DBH tape measure, 2 x compasses, clinometer, altimeter, waterproof note book, pencil

3.1.3. Opportunistic Botanical Collection

The collection of herb, shrub and unusual tree material.

Why?: **To produce a species list of herbs and shrubs to compliment the tree data and preserve specimens for use at the National Herbarium in Arusha and interested international botanical institutions.**

How?:

- **Plant material with fruits and/or flowers are collected as they can be identified with greater accuracy.**
- **This activity is primarily carried out by Albert Ntemi (EUCAMP) throughout the field work.**
- **Plant material is pressed, dried, numbered, described and habitat notes are recorded of the collection site.**

EQUIPMENT USED – Plant Collection

secaturs, plastic bags, plant press, old newspapers, blotters, corrugated dividers, altimeter, note book, pencil, map.

3.1.4 Dung and Disturbance Surveys

These are carried out along all the TRANSECT LINES.

Why?:

- **DUNG is collected to identify the presence of rarely seen and nocturnal animals, such as Duiker and provide information regarding their abundance within the forest reserve**
- **DISTURBANCE is assessed to provide an indication of the quantity of wood harvested and other pressures upon the forest reserve as a result of human population use.**

How?: A group of 4 people make up a Dung and Disturbance survey team.
The survey is carried out along the TRANSECT LINES
The Working Procedure outlines how the team works.

Working Procedure for DUNG AND DISTURBANCE SURVEY

- The survey is carried out once the **TRANSECT LINE** has been cut.
- Two people, one positioned either side of the **TRANSECT LINE** counts the number of *old cut*, *new cut*, *live* and *natural dead poles* (trees between 5 cm and 15cm DBH) and *timber* (trees greater than 15cm DBH) within 5 m of the transect line.
- A third person searches for dung and collects samples.
- A fourth person records the data every 50m. In addition to the numbers of poles and timber, this person records significant features such as evidence of fire, animal traps, cultivation, access paths, fuelwood bundles.
- The *Disturbance Data Sheet* and *Dung Data Sheet* provide the more detailed information.

EQUIPMENT USED – Dung and Disturbance Survey

Panga, pots (to collect dung), DBH tape, 10m tape measure, waterproof note book, pencil.

3.2 Zoological work

Why?

- **The aim of this survey work is to compile species inventory lists of mammals, amphibians, reptiles and selected groups of invertebrates within the forest reserve.**
- **Certain animals were selected to survey. These are *rodents, shrews, bats, frogs, snakes, lizards, butterflies, millipedes, molluscs* and *birds*. There are 4 main reasons for surveying these groups of animals:**

5. **There are national and international experts who are willing to formally identify the animals.**
6. **These animals can be studied effectively within the time frame.**
7. **There is published literature regarding some of the above animal groups, which can aid field identification.**
8. **However, there is little comprehensive ecological data published regarding most of the animal groups and many are poorly understood. Thus through the collection of specimens and ecological data, scientific knowledge can be increased and in turn aid the conservation of the forest reserves.**

How?
The above groups of animals are generally surveyed at trap sites by a variety of methods and through opportunistic observations.

EQUIPMENT USED – Zoological work
100 Sherman live traps, 33 Bucket pitfall traps, 9m, 6m, 3m Bat mist nets, butterfly canopy traps, butterfly sweep nets

3.2.1 Trap sites

Time frame: 10 night trapping period
Locations: representative habitats within a forest reserve.
Methods: different methods are used to survey different species (see below for further details).

3.2.1.1 Sherman Live Trapping

Rodents are sampled using Sherman live traps, which do not harm the animal. 100 traps are generally set out in three lines, surrounding the bucket pitfall trap lines (see below). 33 traps are positioned at least 2m apart around the pitfall lines. Traps are set each evening and checked early the following morning. Each mammal caught is weighed, measured and habitat notes are recorded, for details see *Specimen Data Sheets.*

3.2.1.2 Bucket pitfall trapping

The bucket pitfall traps consist of three lines of 11, 20 litre plastic buckets sunk in to ground (holes are dug and the buckets are placed in the holes). These are positioned approximately 5 m apart. A continuous piece of plastic sheeting runs in a straight line over the ground and the centre of each bucket. Animals are channelled along the plastic and fall in to the buckets. Shrews, frogs and snakes are generally caught in the buckets. The *Specimen Data Sheets* provide details of the information recorded when an animal is caught.

3.2.1.3 Bat netting

Mist nets are used from dusk until dawn to sample bats. Nets are placed near potential roost sites and across flight "corridors", such as paths and streams. Netting is carried out at each trap site and other suitable sites, as time will allow. Each bat caught is weighed and measured at the netting site. The *Specimen Data Sheets* provide details of the information recorded when an animal is caught.

3.2.1.4 Butterflies

Butterflies are sampled using canopy traps and sweep nets. Canopy traps are set at different heights within the tree canopy at each trap site. Rotting banana is used as bait. Traps were checked at midday. Traps are set for 10 days in each of trap site. Butterflies are caught with sweep nets for one hour between the hours of 12:00 and 14:00 for each of the 10 day trapping period.

3.2.1.5 Molluscs & Millipedes

Three sites with representative microhabitats are selected at each trap site. At each of these sites a 1m x 1m quadrat is established to survey molluscs and 3m x 3m quadrat is established to survey millipedes. In each square, the leaf litter and the first 3 cm of soil is searched carefully for molluscs or millipedes. All specimens are collected.

3.2.2 Opportunistic Observations

Observations of other mammals, particularly primates, are recorded throughout the survey. Birds are observed on a casual basis as they are not sampled systematically. Opportunistic captures of reptiles and amphibians can be made by hand, or with a snake stick where necessary. After rain, typical amphibian habitats are targeted for sampling. Butterflies are also collected casually in addition to those found at trap sites.

4.0 DIAGRAMS

Diagram 1: Shows transecting methodology where T1=Transect 1, CL1=Central Line 1,
. ■ = Vegetation plot position ⬭ = inaccessible cliff

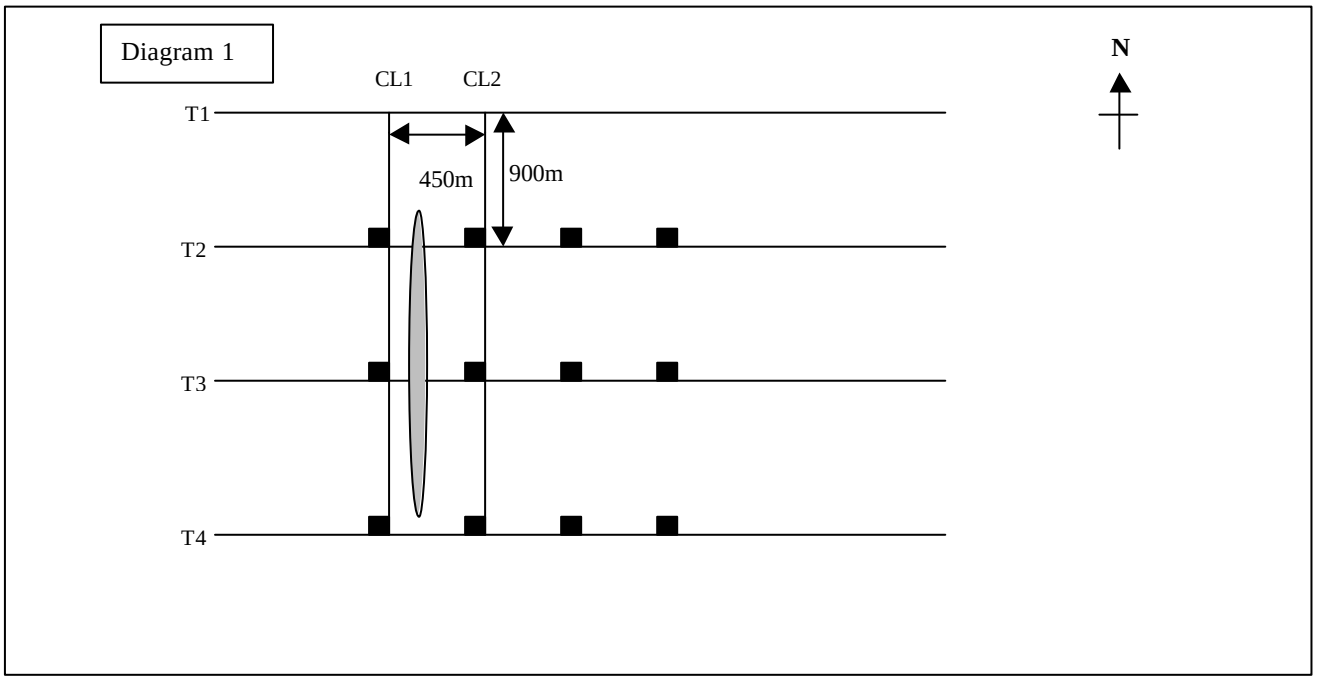
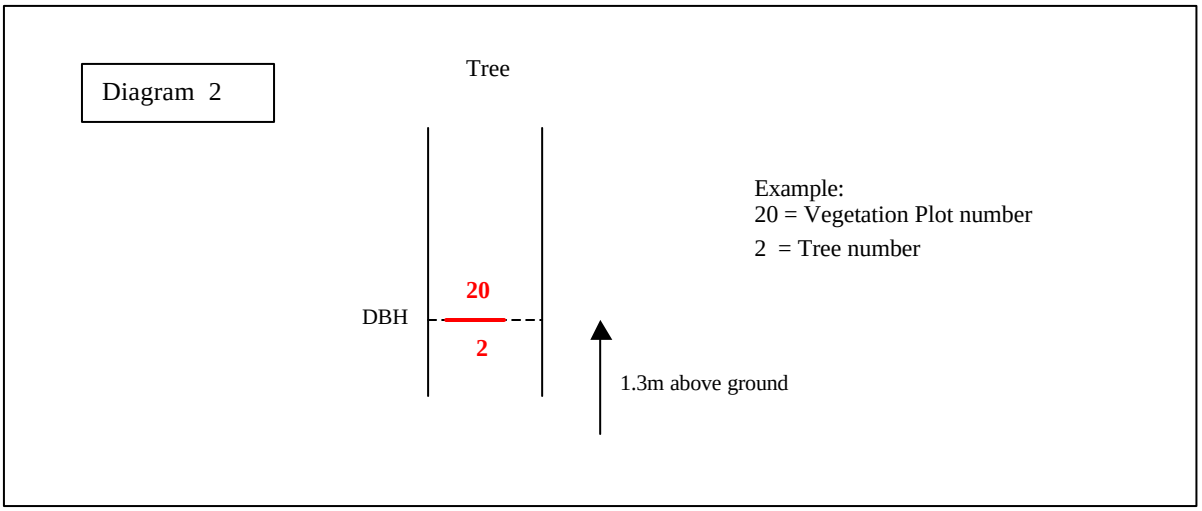


Diagram 2.

A diagram of diameter at breast height (DBH) measurement of trees (>10cm DBH) and the painting protocol. Plot number (e.g. 20) is painted above tree number (e.g. 2), with a line between the two showing where the DBH was measured.



5.0 EQUIPMENT REQUIRED

EUCAMP Officers are required to bring the following during participation with EUBS:

- Strong walking boots
- Water bottle
- Warm and waterproof clothing
- Note book and pen
- Ruc-sac or bag to carry their belongings.

6.0 REFERENCES

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7.0 NOTES

For further details regarding aims and methodologies of EUBS refer to the EUBS Terms of Reference, the Technical Paper series of EUCAMP and the SEE Methodologies 'Old and New'.

For further information with regard to the East Usambara Mountains and the Eastern Arc Mountains refer to the above references and those of the EUCAMP Technical Paper series, in particular from Forest Reserve Biodiversity Surveys, Technical Paper 30 onwards.

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