



THINK NAMIBIA Sustainable Forest Management

Shitambo shambapira yino shakutapa mapukururo kuhamena livaruro lya wiya namulyo wakutikitamo nakuveverera liruwanito wiya munaruwa ntani mulyo walitulitopo likungo wiya.

LITWAROMO

Shimwe shakugwanitamo mulivaruro runone rwamuwiya kuruwanita mulyo wa runone oru rwakaropo mulivango lyawiya; evi kwavi ruwananga palivaruro lyawiya. Livaruro lyawiya kwalitulitirepo mukutwara muutjirwe warunone rwamuwiya rwakalire kunakupwa muEuropa. Mwaka dadingi dinakapito, livaruro kavaliruwana muudjuni mudima.

Mpili momu vyakarashi livarurokwalitulitirepo nashitambo shakukonakona likaropo lyavitondo, vyakara shiruwana shamulyo shakutwikira shiruwana shakunomena runone rwamuwiya. Livaruro wiya kwakaranka nalikukwamo lyakutjangita likungo wiya, evi vyakarero mokunkondopeka liruwanito wiya munaruwa mushirongo. Livaruro lyalinene naghunongontjo kwauruwanita muNamibia, kutamekera palikengururo palivhu dogoro nange pantambo yapawiru kuruwanita likengururo lyapa unongontjo. Vatungi mumakungo wiya kwava korangedanga mukuruwana livaruro mukurenkera vakare nalikukwamo lyarunone rwamuwiya, ntani mukutikitamo vitikitamo vya litjangito likungo wiya ntani mbapira pulitiro lyaliyanguro.

NKE VINA KUTANTA LIVARURO WIYA?

Livaruro wiya kutantashi ndjenditito yakughupa nalifwatururo lya mapukururo gharunone rwamuwiya palivango lyangandi. Livaruro kwakara nantambo ne dina kukwamoko.



Shifanekwatjangwa 1: Ndjenditito dakuruwana livaruro

MBAPIRA YAMAPUKURURO KUHAMENA:

Livaruro lyaWiya

Livaruro kutapa mapukururo djuni kuhamena unene, vingashi mafatururo na ukoramene ntani kutanta runone rwamuwiya. Vyavyo kwakara namulyo mukutapa mapururo kuhamena vimenwa vyavipe evi vina kukuliro muufwandi.

Kutwara mumbunga yakareropo ndya naunandima, vimenwa vyakukuliramo "mudjumo wavitondo vyakuparuka kupitakana X SM (sentimeta) mumukumo muna upatji namunaure (MMM)". Evi vinakwateromo shitondo kutundilira palivhu dogoro munaghure washo dogoro ku uhura wamukumo gho sentimeta, vyavyonka kuhamitiramo nadimutavi kutikakumukumo wakushayera ku W sentimeta. Nkeshi shirongo kufaturura ntambo X, Y na W mulyo wayo.

KONDA MUNKE VYAKARERA MUYO WA LIVARURO WIYA MURUHA RWALIRUWANITO WIYA MUNARUWA?

Livaruro wiya kwakara shiruwana wiya munaruwa ntani kuviruwana mumafanayiko namakeverero runone munaruwa naviruwana, unenepo vitondo.

- Livaruro kwakara namulyo mukutanta mukumo warunone rwamuwiya oru runakarapo mukuruwanita na kuruyangura, shinenepo mulifanayiko yereko nalighano yendito lyawiya ntani nakutapa mbapira pulitiro dakuyangura.
- Livaruro kutapa mapukururo namakonakono kuhamena likuro lyavitondo, evi virenkito muyive nakunongonona mulyo.
- Mavaruro ghamwe maghayarero ghawo, yira likuvhukito lyavitondo, likuro, kutapa mapukururo ndi rondoro, ghaukaro mpepo ntani makutjindjo ghamwe ghaunantjitiwe.
- Livaruro lyakara namulyo wakunomena pakughayarera mulyo wavitondo vyamuwiya ntani kunongonona udito wakutundilira kumundiro. Evi vyakara namulyo wa unene mukuyititapo ndjira dakukeverera namapukururo.

NDJENDITITO YALIPONGAYIKO MAPUKURURO GHALIVARURO LYAWIYA

Lipongayiko mapukururo kuhoroka kutwara mushitambo naliyereko lyalivaruro, ntani narunone rwa pashintu oro runakaropo.

- Vitambo vya livaruro:** Livaruro kuliruwana rumwe ndi kulivyukuruka. Livaruro lyarunone rwashirongo rwamuwiya kwashwa kuliruwana kunyima yamwaka murongo. Shingi shalivaruro lyawiya kudemenena pavitondo vyamulyo. Virugho vimwe kukara navitambo vyakuwederera ko, yira kufaturura maruha ghawiya.
- Siviha solivaruro:** Kuvhura vikare kulivango lyoalididi ndi lyalinene.
- Uyivi ndi runone rwapashintu:** Uyivi munke ndi runone rwapashintu oro runakaropo mukuruwana livaruro?
- Likaro po lyamakwatitoko mapukururo:** Shihonena, likwato mpepo navikwata maywi namafano ogho ana karopo?

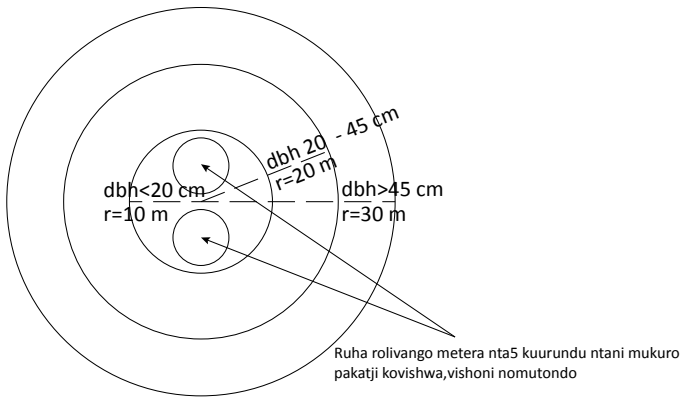
Likonakono lyawiya

Ndjenditito yalikonakono lyamuwiya kutapa makupukururo kuhamena palivhu mumbunga yalivaruro. Evi kusheshupita ndjenditito damukosho kuvantu vakudimukunda. Shishetikito shalivango kuvhura kushivarura, mukonda livango lyalinene mukosho walyo kuvhura uyeruke, vyavi wako shishetekito shakukarererapo kwavi tulitapo, evi kuvhura kuvivarura kehepano kutwara kumapukuro ogho ana karopo.



Lifano 1: Kusheteka mayura ghavitondo muwiya (Kwavipulitira: N. Baptista)

Likukwamo Iya Namibia Finland lyakuruwanita wiya kwakalire shiruwano shakuruwana livararuro Iya pantambo mukunda mumwaka wa1990s. Livaruro lino kwalitulitapo kuruha rwambindakano na ucuma waShirongo, mukuwanita viruwana vyamuwiya namaruha ghamwe ghamuwiya mukuwana mapukururo. Eyi ndjenditito ya kuruwana nawa muwiya yakugharuka mu ukaro mpepo ya rukukutu.



Shifanekwatjangwa 2: Lifaneko lyolivhu lyokuhangura (Burke, Juola & Korhonen, 1996)

Sitafurafaneko 1: Mayereko patameko noyiruganeso

METERA	VIRUWANITO VYAVYO
Unene	Shimetito muna upati, shimetito shashitondo ndi shimetito mutunda
Munaure	Shimetito munaure ndi ure wapara
Ruha rwawiya	Ngodi yokumetita(shimetito mutunda)
Mudjumo	Shimetito shamudjumo
Ruha	Shivarulito Didiliko Livango (SDL)
Likuvhukito	Shitondo shakumetita
Mbando yaliwiru	Shimetito mbando

Shikwatamafano mumpepo

Lirayero lighayarero ndjo ndjira yimwe yaureru yakuvarura livarur olyo ufwandi. Yayo kupulitira likuro pawangu-wangu Iya vimenwa mukuvyukira nampili parutatu mulikuro mulivango lyalinene pakuvyukuruka. Pamavango ghamwe gho kirometera mbiri kuwiru, vyakara mbiliha unene kupitakana liruwanito vikwatampepo namaunongontjo ghapa unandunge mukuwana makoshonono ghakukufana. Liruwanito lirayero ndjenditito yahepa uyivi ghapa manongontjo nakuyiva shiweni mwakuviruwana, evi ghuvhura kuwana kukukwata ukwawo namaruha ghapeke nashure dapantamboyakuyeruka edi darughanango makushongo kuhamena vya livhu namakonakono ghakuruwanita lighayarero. Makonakono ghamwe ghamuwiya kuvhura kushana mashetakanito, yira unene wa shitondo, evi vya karo mulyo mu livaruro Iya wiya.



Lifano 2: Shikwatampepo varuwanita mukuwana mapukururogho ufwandi (Kwavipulitira: V. Amputu)

Manongonono ghamavango (MM)

Manongonono ghamavango kuhamitiramo maghayarero ghamapukururo ghakutundilira ku ndira, ndi vikwata mpepo. Mafanogha vikwata mpepo ndi mafano gha pamavango kuvhura kugharughanita mukuwana mapukururo ghamaruha ghakuvatera wiya mukughayarera mukumo wavikuni, ghukorameno wa wiya, ntani mudjumo wapamavango gha manene. Liruwanito mapukururo gha pepi kurenkita mukuwana ghukanguki wavitondo ntjene vinakara namahako. Mapukururo ghakuvyukuruka kuvhura kugharuwanita mukughayarera likutjindjo Iya wiya ntani na para metera dimwe mwayendo mwaka. Mapukururo gha linongonono livango kuvhura kuliruwana mukufaneka likonakono lyalivango. Unenepo deghura kuhamena mbapira davikwata maywi nampepo kwavihepa mukuviruwana mumavango ghakuku hanguro shikare shiruwano shakuruwanita palivaruro. Liruwanito likonanokono palivango muNamibia kwakara shilimbikwa mukonda wiya wakupanauka pamavango ghamwe, evi vya twalidirango kumafano ghamwe gha kuku vhonga-vhonga pakumoneka: Vyavyo kukuvhonga nalimoneko Iya vitondo, vishwa, livhu, ntani paviruwo vimwe limoneko Iya mundiro, evi kurenkita vikare udito mukudimburura likushuvo Iya wiya na mavango gha vishwa.

QGIS

A Free and Open Source Geographic Information System

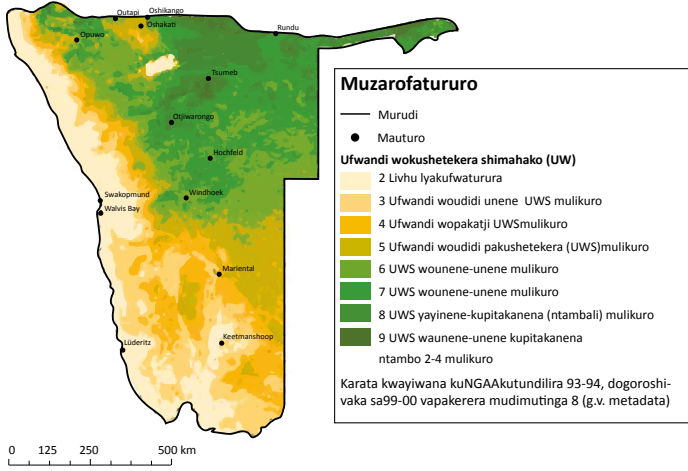


Shifanekwatjangwa 3: Livango lyomapukururo ghopa unongontjo gho livhu shiruwana shakukurongakuhamena mavango hanguro nomapukururo ghamo (<https://qgis.org>)

Lighayarero lya furagha yavi kuliramo ndi mudjumo

Ntambo yakuhova yakughayarera likurolya vimenwa kwaviwananga mukushetakanita wiya owu vahangura nalivango lyamo.

Ufwandi wokushetekera shinamahako mutitu muNamibia



Shifanekwatjangwa 4: Vifwandi kuvhuranka kughugarerakutwarakumudjumo walivango hanguro, eviviyivito ilruwanito mpepo yayidona (Kwavipulitira: University of Cologne)

MuNamibia vimenwa vyakukuliramo kwavivaruranga namukumo wavitondo vyakaro kupita centimetera 5 mumukumo vinokuwedako nadimutavi nadintje. Lishetakanito nalyo kwalitulitapo muruha rwa likuyuvho vanakutwenya liwapayiko lya wiya lya Namibia-Finland ntani kutwara kuvitondo evi vyawiro mumarugha shirongo mane, Zambezi, Otjozondjupa, Oshikoto ntani rugha shirongo Omusati.

Lingungunyikuro lya likuro vitondo pakurwanita likushongo lyalikuro vitondomuwiya

Likuro vitondo muwiya kutantashi likushongo lyamumwaka lyakuyivita mapukururo kuhamena kumwaka wangandi ndi shinema. Vyavyo kuvirwanita mukudimburura mwaka davitondo nakundimburura mparukito yavitondo mughukaro mpepo wakukushuva-shuva ndi kughukaro walikushinto lya ukaro wampepo. Likushongo lyalikuro vitondo muwiya kutantashi, shangashi, kapi valiruwantanga muNamibia mukonda shing'i shavitondo kapi vyakara nalikuro lya kehemwaka, ntani likuro lyakeheshinema pakuvyukilira vanahepa kushetakanita kwakeherudi rwashitondo sha muNamibia pamundinda washo. Mukudililika rutetenyi rwashirongo kulikushinto lya ukaro mpepo, ndjira yimwe varuwantanga mukudimburura mwaka davitondo kukenga kumutika na unene washitondo kutwara munaupati washo.



Lifano 3: Kuruwanita shimetito mukushimba mapukururoku ntjima ntjima yashitondo likushongolya likuro lyawiya

Shitafura 2: Likwatakano tjango lya ufwandi omoghughusetakanita mundjenditito dakuku shuva shuva

	Likonakono wiya	Shikwata mpepo	Livangokona-koneno
Lurunduru-roya ukwatekero	Hawe	Yi	Yi
Mutika	Yimo	Yi, kutwara mulikutundakano kumutika wamunaupati na munaure nomutika wompu	Yi, kutwara mulikutundakano lyamutika muna upati nampu namunaure nomutika wompu
Munaure	Yi	Yi	Yi
Lighayarero mukumo	Yi	Yi	Yi
Ukanguki no Ukalinawa wa vitondo	Yi	Yi	Yi
Ligharero lya mukumo wa vimwenwa	Yi	Yi	Yi
Likuro lya vitondo	Yi	Yi	Yi

Ndjenditito dakukushuva kwakarerapo navitambo vyakukushuva shuva mukunkondopeka maruha tikitomo viruwana evi vyapumbo mukosho nauyivi. Ndjenditito dino kuvhura kudiruwantita mundjira dakuwpera, edi kuvitikitamo namukuhamitiramo mbunga dimwe dapa uholi ntani kuyititapo mauyivi ghakuvyukilira.

UNONGONTJO WA VATUNGIMO NALIHAMITIROMO LYA VAKAMUKUNDA MULIVARURO LYA WIYA

Vyakara mulyo unene kuva ka mukunda mukukuhamitira mulivaruro lyawiya mukonda shasho shiruwana sha kutapa mapukururo kuhamena ash'i weni mwakuvhura kufanayika ntani liyendito lya viruwana. Yayonka mpito yayiwa mukukulika pamaghano nokuyititapo ghuyivi waliyivo lya unankondo wapaumwene.

- Mauyivighamwe ghapa ntateko ghamuwiya kuvhura kugharuwana vakevereli ntjitwe avava tu litapo pamukunda, vatungimo, yira likungo wiya lya likwaterera, kuvhura vaviruwane pakutikiliramo.
- Vastudente va kushure kurona, unenepo vamomo mulivango, kuvhura kuvakuta varuwane livaruro shikare shinakuweda kumakushongo ghavo muliruwano kumwe na vatungimo mumukunda.
- Shure dakaro pepi namavango ghano kudikorangeda vakwatitekolivaruro lya wiya yikare mpito ya mbunga dakukushonga vikwa ntjitwe paviruwana vya pandje.
- Makukwatakano nalitungo ukumwe kwavikorangeda unene, shinenepo shure kurona dapa ntambo mukunda nambunga dakurwana makonakono, mbyovyoshi edi ndo dimwe ndjira dakuwana mauyivi mudeura mulivaruro lya wiya, likengururo ntani na lifatururo.

Livaruro lyawiya kwakara shiruwana shamulyo unene mukuyendita wiya ntani, ntjo shimwe shakutapa mapukururo mukuruwana matokoro. Livaruro eli vatokora vakamukunda linahepa kuku yenda na livango mukukevererashi kuvhura vawanange mapukururo kehe ruvede vanaghashana. Shakara udito unene mukudimburura ashii viwanamo mukukukwata uholi namavango ghakukukarera ogho ghavhuro kuvatera kuwapukurura makukwamo gha livaruro.

LITOROKO LYANKANGO

Mbando yakuwiru [Canopy cover]:

Kwayivikwa nkashi mbando yayo yalivhu, eyi vafika naprojeka ya mbando ya vitondo.

Uyivi wa unongontjo walivhu [Dendrochronology]:

Uyivi na unongontjo wa vakamanakandongo mukudimburura mwaka da vitondo pakuruwanita mutikawa vitondo.

MUU [DBH]:

Mutika pa unene na ure, ogho mutika wa shitondo pakushisheteka muna ure wa kutika ku metera 1.3 kutunda palivhu.

Mukumo wa Wiya [Forest biomass]:

Eyi kwahamitiramo maruha gha vitondo, yira madi ghavitondo, mampagha, nadimutavi, vihako rambangako na ndandani.

RMNGIS [GIS]:

Ruha rwamapukururo rwa ntjitwe, ndjenditito mukuwana mapukururo gha mumpompa ntani mapukururo gha ntjitwe mukughapongayika, kugha kengurura nakugharuwanita mukutulitapo karata.

Likonakonolivango [Remote sensing]:

Eyi ndjenditito yakuwana mapukururo kuhamena projeka yakaro ure, mukuruwanita shikwata mpepo ndi ndira yakutuka yamuwuru.

Mbando yamutitu [Vegetation cover]:

Oru ruharwalivhu oru rwakaro mutitu. eyi kuvhura vikare mutitu wakuku shuva-shuva, yira mushoni vimenwa ntani vitondo.

Shivaropongo [Yield]:

Mudjumo waviruwanita vyamuwiya ndi runone oru rwakaro muwiya rwakuvhura kuyangura ndi kuruwanita.

MAPUKURURO GHAKUWEDAKO

Burke, A., V. Juola, & K. Korhonen, 1996. *Field instructions for the NFI* (Namibia Finland Forestry Programme, National Forestry Inventory Sub-component). Ministry of Environment and Tourism, Windhoek.

De Cauwer, V., 2016. *Towards estimation of growing stock for the timber tree Pterocarpus angolensis in Namibia*. Namibia University of Science and Technology.

De Cauwer, V., 2020. The timber harvest peak of 2018 in Namibia. *Roan News*, Namibia Environment & Wildlife Society, Windhoek.

De Cauwer, V., N. Knox, R. Kobue-Lekalake, J. Lepetu, M. Ompelege, S. Naidoo, ... & R. Revermann, 2018. Woodland resources and management in Southern Africa. In R. Revermann, K. Krewenka, U. Schmiedel, J. Olwoch, J. Helmschrot, & N. Jurgens (ed). *Climate change and adaptive land management in Southern Africa-assessments, changes, challenges and solutions*. Klaus Hess Publishers, Goettingen and Windhoek, pp. 296-308.

Kanime, N., 2005. *Global forest resources assessment: Country report-Namibia*. FAO, Rome.

Mati, J. & S. Dawaki, 2015. Role of inventory in sustainable forest management: A review. *International Journal of Forestry and Horticulture*, pp. 33-40.

Morales, D. & M. Piazza, n.d. *Forest inventory: Basic knowledge*. FAO, Rome.

Seppanen, H., 2001. *The Namibia Finland Forestry Programme*. IFFN, Windhoek.

Shikanghala, S., 2020. Dendrochronology in Namibia: A review. *International Journal of Environmental Sciences and Natural Resources*, pp. 192-200.

'Promoting Sustainable Forest Management in the Kavango-Zambezi-Region in Namibia'



This project is funded by the European Union

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Nkurupemba 2021

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