Flexible Canopy Netting Rig and Audio Lure Placement for Woodpecker Capture

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ABSTRACT

We describe a new, modern canopy mist-netting rig and audiolure broadcast approach for target netting Red-headed Woodpeckers (Melanerpes erythrocephalus). *Using our canopy rig, we captured four adult Red-Headed Woodpeckers in six capture attempts versus capturing one adult Red-headed Woodpecker and an additional non-targeted species in five ground-based mist-netting attempts. Our results demonstrate that a flexible mist-netting approach coupled with audio lures allows for the capture of woodpecker adults while reducing non-target species captures. We suggest our technique may be used to capture additional canopy-dwelling bird species during the breeding season.*

INTRODUCTION

Using mist-nets to capture birds is reliable, safe, and widely-used during bird banding and research (Spotswood et al. 2012). Since April 2018 we have been target-netting Red-headed Woodpeckers (*Melanerpes erythrocephalus*) in northern Illinois to determine drivers of breeding success in this declining species. Though Red-headed Woodpeckers frequently forage on and swoop low to the ground (Kilgo and Vukovich 2011, Reller 1972, Rumsey 1968), at our urbanized study sites, we rarely observed ground-foraging behavior or low, swooping flights. Instead, we have frequently observed woodpeckers flying and foraging in the canopy at approximately 15 m in altitude. This height exceeded the reach of a ground-based mist-net capable of capturing birds up to 3 m above the ground. Additionally, previous work that compares species captured in ground-based nets versus canopy nets caught only Red-headed Woodpeckers in the canopy rigs (Bonter et al. 2008). As cavity-nesting species such as woodpeckers can be difficult to capture (Bull and Cooper 1996, Lehman et al. 2011) and a conventional mist-net setup often falls short of sampling goals around these species, we realized the need for a specialized target netting rig.

For several decades, ornithologists whose projects require canopy access have found ground-based nets to be inadequate (Chmel et al. 2016, Derlindati and Caziani 2005, Humphrey et al. 1967) and to counter this shortcoming, have designed ways to elevate mist-nets. These include stacking nets on telescoping poles or rigging aerial nets with pulley systems. While telescoping poles and triple high mist-net pole systems can extend nets up to 9 m into the canopy (Meyers and Pardieck 1993, Williams-Guillén and Perfecto 2010), these setups exceeded our budget and fell short of our height requirements. An alternate method of setting a mist-net in the canopy is to construct an aerial net that is anchored with a pulley system to trees rather than using ground-based poles or frames. An aerial mist-net apparatus on a rigid frame, such as described in Whitaker (1972), Munn (1991), and Stoleson et al. (2016) did not serve our purposes because to efficiently target-net Red-headed Woodpeckers at multiple sites, we needed a setup that was easy to move, carry, and stow in a small truck bed. Finally, due to site permitting restrictions, we could not build permanent structures on-site, ruling out elevated platforms in trees such as those described in Stokes et al. (2000). We decided to modify existing aerial mist-net setups and audiolure use

described in Humphrey et al. (1967), Whitaker (1972), Munn (1991), Stokes et al. (2000), and Stoleson et al. (2016) to meet our unique research needs.

We needed to create a rig that was cheap and durable, requiring minimal materials, was easy to set up and take down, was easily transportable to facilitate repeated deployments in different target woodpeckers' territories, was flexible for any tree configuration, captured only the target species, was not overwhelmingly destructive to vegetation in the netting area, and did not require tree climbing skills. As Red-headed Woodpeckers are highly territorial and respond aggressively to playback (Reller 1972, Yohannes 2017), we coupled the aerial net design with the use of two audiolures that altered our targets' flight patterns. Our setup is easy to learn, easy to deploy, is minimalist in terms of material cost and quantity, and is effective for target-netting high-flying woodpeckers.

METHODS

Rig design and deployment. - We systematically surveyed sites using conspecific playback to define Red-headed Woodpecker territories and nest cavities to optimize canopy mist-netting deployments. For example, before setting nets near cavities, we observed woodpecker behavior so we could hang nets across preferred flight paths. This reduced retrospective net manipulations. In evaluating net placement, we searched for high anchor points of comparable height, spaced approximately 15-25 m apart, ground anchor options, and potential net hindrances such as errant branches. Our rig was easiest to set up in relatively flat areas with minimal understory.

Our flexible rope rig setup consisted of a high anchor line with pulleys attached, two working lines that hung perpendicular to the high anchor line that we could raise and lower using the pulleys, and a mist-net tied to the working lines (Fig. 1). To set the high anchor line, we employed equipment commonly used by arborists, including a throw bag, high-visibility throw line, and a throw weight attached to the end of the throw line. We used the throw bag to transport the throw line. We also kept as much of the throw line in the throw bag as possible during deployment attempts. Keeping the line in the throw bag allowed the throw line to travel smoothly up into the air during deployments. Leaving the throw line on the ground between throwing attempts caused it to tangle in understory vegetation, arresting deployment.

To set the high-visibility throw line, we picked up the throw weight attached to one end of the throw line and stepped approximately 1 m away from the throw bag containing the rest of the throw line. We pinched the throw line just above the throw weight with our thumb and index finger, keeping the rest of our fingers wrapped loosely around the line. We then released our thumb and index finger, letting approximately 30 cm of line to run through our fingers, and pinched the line again, curling the rest of our fingers loosely around the line. Planting our feet and keeping the hand holding the throw line at hip-height, we slightly swung our forearm back and forth to give the throw weight at the end of the line momentum, until the weight at the end of the line swung like a pendulum towards a target branch. On an upward trajectory, we let go of the line, causing it to shoot up towards our target following the weight, with the body of the throw line playing out from the throw bag. It was important to let go of the throw line quickly, otherwise, as the line played out and shot up towards our target, it rubbed against our palms. We wore thin latex gloves to prevent rope burn; wearing thicker gloves prevented us from deftly handling and releasing the throw line during a deployment attempt. If a throw was unsuccessful and fell short of our target branch, we placed the throw line back into the throw bag, making sure it had no knots in the body of the line, and attempted another throw. If the throw was successful, we continued playing out the line until the throw weight dropped within arm's reach.

After setting the throw line, we removed the throw weight, then tied the throw line to the high anchor line, a thicker 200-m rope that served as a flexible frame for our canopy mist-netting setup, with a clove-hitch knot. We then pulled one end of the high anchor line over the target branch by pulling on the throw line and anchored it. Then, we reset

the throw-line over a second branch, clove-hitched the throw-line to the second end of the high anchor line, drew the second end of the high anchor line over the second target branch, and secured it. It is important to secure both ends of the high anchor line when they have been successfully pulled over the target branches; we used trees, sewer grates, and even backpacks as ground anchor points.

We left slack in the center of our high anchor line, letting it hang low so that we could easily reach it. We then attached two pulleys in the middle of our high anchor line, 6 m apart from each other, and threaded two shorter working lines, one through each pulley. The working lines served as flexible mist-netting "poles" in our setup. After securing the working lines to ground anchors, we removed large rocks and branches and spread a 7-m tarp underneath the high anchor line. We laid out a furled 6-m mist-net with 60-mm mesh lengthwise across the tarp, then tied each net loop to the working line, making sure to space mist-net trammels appropriately to leave pockets and prevent woodpeckers from bouncing out. Finally, we tied a throw-weight to the ends of both working lines to make sure the net hung vertically once deployed in the canopy. To raise the net into the canopy, we pulled both ends of the high anchor line until it was taut and tied them off, then pulled the working lines in unison and anchored the free ends. If no nearby anchors were available for the high anchor line or working lines, we tied off free rope ends to a ground anchor line (Fig. 1). With practice it took 10-15 min for two people to set up a net using our rig setup.

Knots used in setup.—We used several knots in our canopy rig setup. The clove hitch knot, used to attach the throw line to the high anchor line, created a flat, friction-reducing surface which allowed us to pull the thin throw-line and one end of our high anchor line over the target branch without snagging. We also used the clove hitch when securing the high anchor and working lines. We threaded 15 cm of rope through a pulley and used a double fisherman's knot to create small loops for our pulleys. We took the small pulley loops and used prusik knots to attach the pulleys to the high anchor line, 6 m apart. Finally, we used alpine butterfly knots, which are easily untied and adjustable, to tighten the ground anchor line.

Using audio lures to attract woodpeckers.– Upon setting up the net, we used recordings to attract Red-headed Woodpeckers to our net. Stoleson et al. (2016) used an FM radio and an mp3 player with a long wire to capture Cerulean Warblers (*Setophaga cerulea*) and Scarlet Tanagers (*Piranga olivacea*). We updated their design and used wireless Bluetooth speakers connected to our smartphones, which allowed us to place speakers near the net and play recordings while remaining concealed to our target species.

Initially, we placed one Bluetooth speaker directly underneath our net. This attracted adult Red-headed Woodpeckers but often birds spooked and veered from the net. We then tried using two speakers, placed approximately 10-20 m apart on opposite sides of the net. We placed speakers at ground level or in nearby shrubs up to 2 m in height. By always employing the speaker across the net from our target Red-headed Woodpecker and silencing the second speaker, we were able to provoke numerous passes from our target through the net area while also drawing the woodpecker's focus to vegetation beyond, instead of directly underneath the net. One of us (AAR) experimented with the same audio lure technique, using two speakers to successfully capture Black-backed Woodpeckers (*Picoides arcticus*) in Lassen and Plumas National Forests in 2013 with The Institute for Bird Populations researchers.

Modifying net placement after deployment.—Occasionally, using audiolures to attract woodpeckers did not result in a flight path that intersected the mist-net, and we needed to move the net. We were able to modify net placement after deploying the net in several ways: by pulling on one side of the high anchor line we could slide the net sideways, and by loosening the high anchor line and moving the ground line and working lines, we could swivel the net.

Lowering, transporting, and storing the net.--When a capture occurred, we lowered the net into the tarp by untying and freeing the working lines.

One person managed both working lines while another extracted the woodpecker. To completely drop the net, we untied the high anchor line and pulled working lines, dropping the entire rig into the tarp. If we wanted to deploy the net quickly we simply wrapped the rig up in the tarp and carried it to a new location. All rig materials can easily fit into a small duffel bag. We provide a budget breaking down materials and associated costs below (Table 1).

RESULTS

Between May and July 2018, we deployed our aerial net rig and dual audio lures a total of six times over five trapping days at 12-15 m height. We captured Red-headed Woodpeckers on four of these deployments and experienced no fatalities nor captures of non-targeted species. At one site, we deployed the net in two locations before making a capture. At another site, we attracted woodpeckers but were unable to lure them into the net before being rained out. In five additional trapping attempts where we used mist-net poles stacked to a height of 7 m, we captured only one Red-headed Woodpecker adult and additionally captured White-breasted Nuthatches (*Sitta carolinensis*) and Black-capped Chickadees (*Poecile atricapillus*). On our first day of trapping using our canopy rig, a Red-headed Woodpecker bounced out of the net because the pockets were spaced at a distance that created too much tension in the net. We readjusted the net to create larger pockets and soon captured and banded this woodpecker.

Whenever we caught a woodpecker, we raised the net again in an attempt to catch its mate, but never succeeded. Because of the difficulty of determining the sex of Red-headed Woodpeckers in hand (Pyle 1997), we could not determine whether we tended to catch one sex more than another. Our rig design was uncomplicated such that the two researchers who had little previous rope rigging and knot-tying experience were able to successfully rig, deploy, and adjust the net independently after initial guidance.

DISCUSSION

Summary of our improvements to existing canopy netting methods.– Instead of attaching the trammel loops to the working lines with shower curtain rings as in Humphrey et al. (1967) and Whitaker (1972), we clove hitched the loops directly to the working lines. This ensured the pockets stayed fixed with appropriate tension as the net was raised, eliminated the problem of catching the net on the curtain rings during windy conditions, and kept the size of the net pockets adjustable.

Rather than using monofilament fishing line to set the high anchor line, as used by Munn (1991), Vukovich and Kilgo (2009), and Stoleson et al. (2016), we used a thin nylon throw line. Fishing line easily tangles on itself and in the canopy (Munn 1991), can cut hands, and is potentially harmful to wildlife if left in the canopy (Munn 1991). The line we used was thicker, brightly colored easily followed, and did not catch on branches.

To optimize our design's mobility, we did not use a rigid frame as in Whitaker (1972) and Stoleson et al. (2016). It was possible, at sites with concentrated woodpecker territories, to roll the entire assembled setup into the tarp for transport. This significantly expedited deployments.

Certain canopy mist-netting setups require tree climbing to anchor the net (Paton et al. 1992, Whitaker 1972, Humphrey et al. 1967). Ours does not; tree climbing can be time-consuming and hazardous and, in our case, unsuitable for temporary target netting.

Environmental and behavioral considerations.– Our rig setup allows the net to hang from the working lines, such that the weighted ends of the working line swing freely. We found if the weights attached to the end of the working lines are sufficiently heavy and the net is kept from sagging in the middle by adequately spacing the pulleys, breezes did not cause the net trammels, working lines, or high anchor line to swing. The weights attached to the working lines swung slightly during deployment but stopped within minutes of raising the net. Strong breezes and direct sunlight may have allowed woodpeckers to see the net, a

complication documented across netting studies (Whitaker 1972, Furness and Baillie 1981). Nonetheless, we succeeded in luring the birds into the net even in these conditions by alternating the use of two speakers and coaxing woodpeckers to fly repeatedly from one speaker to the other.

Other high-flying woodpeckers, such as the Red-bellied Woodpecker (*Melanerpes carolinus*), could likely be captured using our technique. Indeed, our rig could prove useful for capturing a variety of canopy dwelling birds that are difficult to capture using ground-based nets. Note that our technique may not work outside of the breeding season; we attempted to catch Red-headed Woodpecker adults and juveniles in July and August 2018, but the birds were unresponsive to broadcasts of conspecific calls at that time and we were unsuccessful.

Further improvements.– Color-coding the rope tails, as in Albanese and Piaskowski (1999), would expedite differentiating the lines. Staking the tarp could provide a smoother, more stationary surface to accept the net.

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Table 1. Comprehensive materials list and associated costs for canopy mist-netting setup. Prices listed are as of August 2018; total cost about $460.

Item	Description	Cost	SuggestedSupplier	Model Number
Vtin 20W Outdoor Bluetooth Speaker (2)	Water resistant, durable speakers	$30 ea	Amazon	VS1-VBS008B-VD
Xeno-Canto recordings	Red-headed Woodpecker alarm and contact calls	Free	xeno-canto.org	XC370167
Latex or nitrile gloves	Thin gloves to protect hands while handling ropes	$8.15/100	Amazon	GNEP-SM-1P
Petzl Eclipse Folding Throwline Storage throw bag	Bag with foldable frame holding throw line	$76	Sherrill Tree	39686
Petzl Airline Throw Line (60 m)	Slippery cord used to set high anchor line	$40	Sherrill Tree	39683
Sherrilltree Neo Throw Weights, 12 oz (2)	Throw weights for throw lines and working lines	$17 ea	Sherrill Tree	NEO
1/4 " double braided polyester rope (600 ft)	Lightweight, water and tangle-resistant line in three lengths: 1 high anchor line (200 ft), 3 ground anchor lines (100 ft each), and 2 working lines (50 ft each).	$120	Amazon	B013KCZJ7S
Harken 29 mm Single Fixed Carbo Block pulley (2)	Used to run working lines from top line.	$18 ea	Amazon	B07GNZJBNS
10 x 20 ft tarp	Net placed on tarp prior to deploying	$18	Amazon	B002YKRCI2
6-m, 60mm mesh mistnet	Short net used for woodpecker capture	$68	Avinet	CT06

LITERATURE CITED

Albanese, G. and V. D. Piaskowski. 1999. An inexpensive elevated mist net apparatus. *North American Bird Bander* 24:129-134.

Bonter, D. N., E. W. Brooks and T. M. Donovan. 2008. What are we missing with only ground-level mist nets? Using elevated nets at a migration stopover site. *Journal of Field Ornithology* 79:314-320.

Bull, E. L. and H. D. Cooper. 1996. New techniques to capture Pileated Woodpeckers and Vaux's Swifts. *North American Bird Bander* 21:138-142.

Chmel, K., R. Riegert, L. Paul, and V. Novotny. 2016. Vertical stratification of an avian community in New Guinean tropical rainforest. *Population Ecology* 58:535-547.

Derlindati, E. J. and S. M. Caziani. 2005. Using canopy and understory mist nets and point counts to study bird assemblages in Chaco forests. *Wilson Bulletin* 117:92-99.

Furness, R. W., and S. R. Baillie. 1981. Factors affecting capture rate and biometrics of Storm Petrels on St Kilda. *Ringing & Migration* 3: 137-148.

Humphrey, P. S., D. Bridge, and T. E. Lovejoy. 1967. A technique for mist-netting in the forest canopy. *Bird-Banding* 39:43-50.

Kilgo, J. C. and M. Vukovich. 2011. Factors affecting breeding season survival of Red-headed Woodpeckers in South Carolina. *Wildlife Management* 76:328-335.

Lehman, C. P., D. C. Kesler, C. T. Rota, M. A. Rumble, E. M. Seckinger, T. M. Juntti, and J. J. Millspaugh. 2011. Netguns: a technique for capturing Black-backed Woodpeckers. *Journal of Field Ornithology* 82:430-435.

Meyers, J. M. and K. L. Pardieck. 1993. Evaluation of three elevated mist-net systems for sampling birds. *Journal of Field Ornithology* 64:270-277.

Munn, C. A. 1991. Tropical canopy netting and shooting lines over tall trees. *Journal of Field Ornithology* 62:454-463.

Paton, P. W. C., C. J. Ralph, J. Seay. 1992. A mist net design for capturing Marbled Murrelets. *North American Bird Bander* 16:123-126.

Pyle, P. 1997. Identification guide to North American birds, Part I: Columbidae to Ploceidae. Slate Creek Press, Bolinas, CA.

Reller, A. W. 1972 . Aspects of behavioral ecology of Red-headed and Red-bellied Woodpeckers. *American Midland Naturalist* 88:270-290.

Rumsey, R. L. 1968. Capture and care of Pileated and Red-headed woodpeckers. *Bird-Banding* 39:313-316.

Spotswood, E., K. R. Goodman, J. Carlisle, R. L. Cormier, D. L. Humple, J. Rousseau, S. L. Guers, and G. G. Barton. 2012. How safe is mist netting? evaluating the risk of injury and mortality to birds. *Methods in Ecology and Evolution* 3:29-38.

Stokes, A. E., B. B. Schultz, R. M. Degraaf, and C. R. Griffin. 2000. Setting mist nets from platforms in the forest canopy. *Journal of Field Ornithology* 71:57-65.

Stoleson, S. H., L. Ordiway, E. H. Thomas, and D. Watts. 2016. A mobile target-netting technique for canopy birds. *North American Bird Bander* 41:57-61.

Vukovich, M. and J. C. Kilgo. 2009. Effects of radio transmitters on the behavior of Red-headed Woodpeckers. *Journal of Field Ornithology* 80:308-313.

Whitaker, A. H. 1972. An improved mist net rig for use in forests. *Bird-Banding* 43:1-8.

Williams-Guillén, K. and I. Perfecto. 2010. Effects of agricultural intensification on the assemblage of Leaf-Nosed Bats (Phyllostomidae) in a coffee landscape in Chiapas, Mexico. *Biotropica* 42:605-613.

Yohannes, B. 2017. Nesting ecology of Red-headed Woodpeckers (*Melanerpes erythrocephalus*) in central Minnesota. M.S. thesis, University of Minnesota, Minneapolis, MN.

Red-headed woodpecker Comstock studios (George West)

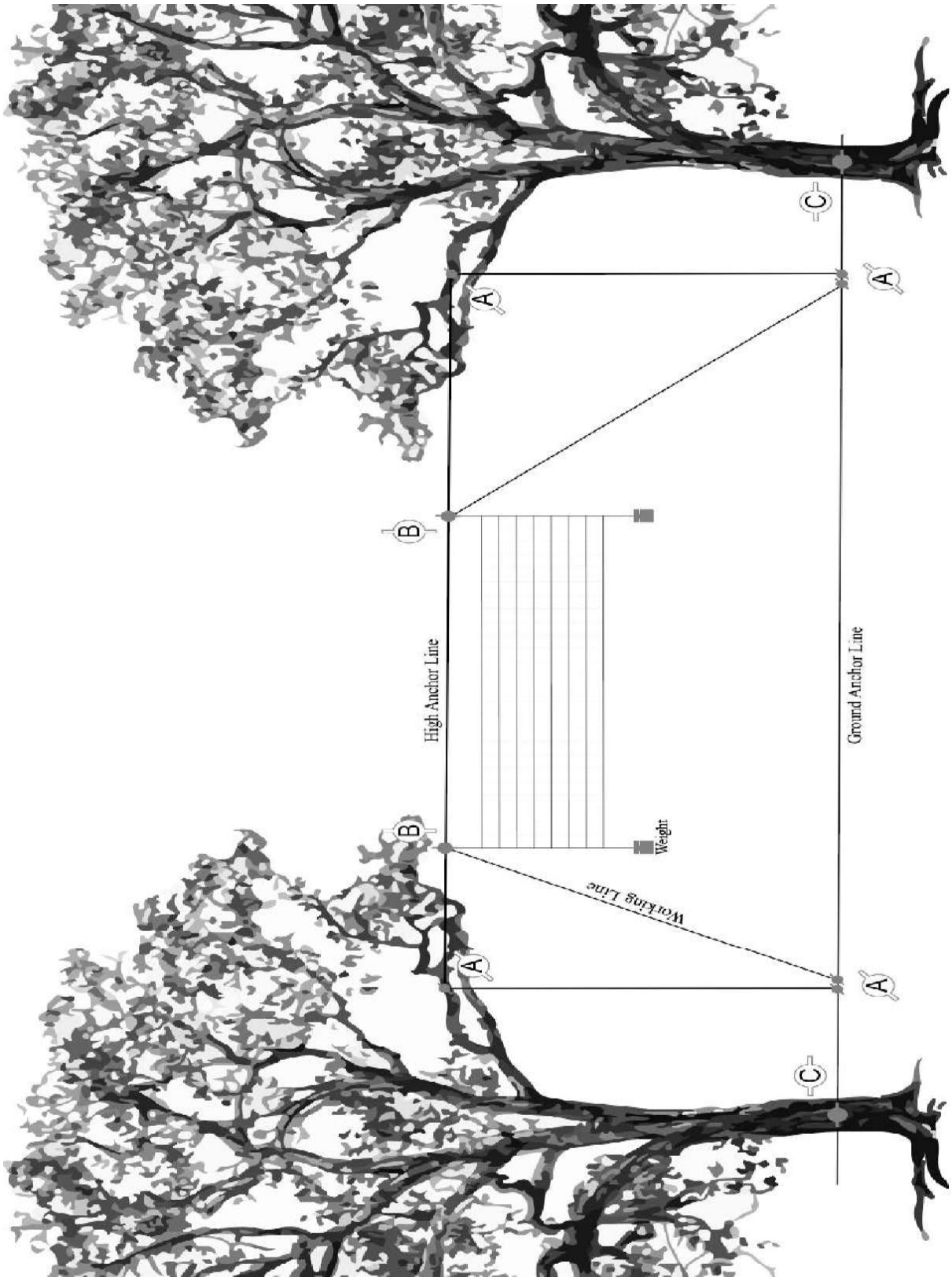

Figure 1. Canopy mist-netting rig showing location of lines, knots, and weights during setup. High anchor line, working line, ground anchor line, and weights are labeled. A. Clove hitch knot used to secure the high anchor line and working lines to the ground anchor line. B. Prusik knots used to secure the pulleys to the high anchor line. C. Alpine butterfly knots used to tighten and tie off the ground anchor line.