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An Artificial Bald Eagle Nest Structure

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Construction procedures are described for an artificial bald eagle nest support structure made of 4-inch aluminum pipe. The hinged, three-pole design permits complete assembly on the ground prior to raising and spreading the legs. The resulting tripod is inherently stable and offers natural support for a bald eagle nest and several perch branches more than 35 feet above the ground.

Keywords: *Haliaeetus leucocephalus*, nest structure, endangered species habitat, wildlife management

Several fallen bald eagle (*Haliaeetus leucocephalus*) nests have been successfully relocated in nearby, healthy trees (Dunstan and Borth 1970, Postupalsky 1978). One pair of eagles has been recorded nesting successfully on a 12-foot, three-legged platform designed for osprey (*Pandion haliaeetus*) in Michigan[2] (Postupalsky 1978). However, a permanent, totally artificial structure constructed specifically for bald eagle nesting was an unproven management technique until a prototype was developed in 1977.

Following the loss of an active nest and two viable eggs (Grubb and Rubink 1978), the structure was designed and constructed to benefit the resident pair of eagles which had a history of building nests in decadent, short-lived snags. Several years are normally required for bald eagles to successfully utilize artificial nest platforms (Postupalsky 1978), yet in 1978 the eagles accepted the tripod for occasional perching and roosting and in 1979 normal nest repair, egg laying, and incubation occurred. Unfortunately, the effort failed because the thin-shelled eggs broke before hatching; however, the artificial structure proved acceptable for bald eagle nesting.[3]

The tripod-teepee design was chosen because of its inherent stability and natural support for the nest and perch branches (fig. 1). Height, materials, use of shade, and other factors can be varied as circumstances require. The structure offers a new management dimension in supplementing marginal or deteriorated habitat and

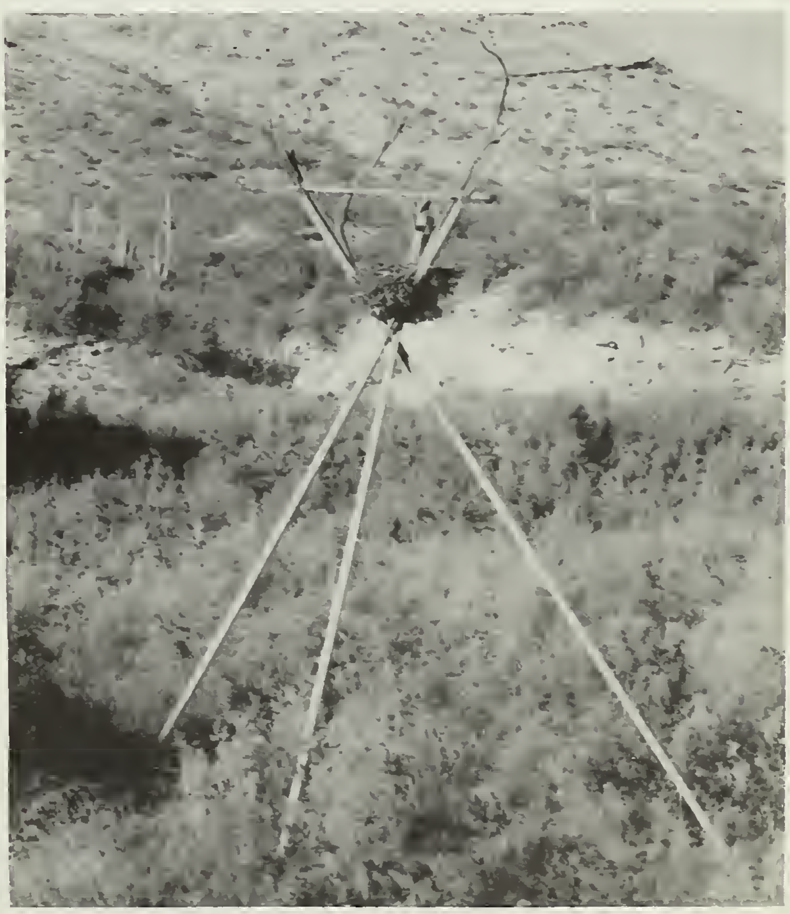

Figure 1.—Bald eagle nesting tripod.

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[2]*Personal communication with Ralph E. Bailey, Michigan Department of Natural Resources.*

[3]*Teryl G. Grubb, Bald eagle activity at an artificial nest structure in Arizona. Manuscript in preparation.*

possibly in relocating nests to more suitable, less disturbed sites within an existing territory. Relocation is easily accomplished by removing the footing bolts, loosening the hinge bolts, and air lifting the collapsed tripod to a new location. This technique is being tested with the prototype structure during the 1980 breeding season; results will be reported when available.

Materials

Four-inch (inner diameter) aluminum pipe with 0.25-inch walls is recommended for the tripod because of its light weight and strength. Seven 20-foot sections of this diameter pipe are required to make the legs. One section is cut into three, equal, 80-inch pieces that ultimately serve as the upward extensions beyond the apex joint (fig. 2). Each leg is comprised of one short length and two standard, 20-foot lengths. Inner sleeves for the joints are made 40 inches long by cutting a 20-foot length of 3.5-inch-diameter (0.25-inch wall) aluminum pipe into six equal pieces. These sleeves, which fit perfectly into the 4-inch pipe, are inserted equidistantly into the two pipes being joined and bolted in place. Two 0.5-inch-diameter by 6-inch steel, machine bolts are used on each side of the joint, approximately 6 and 12 inches from center (fig. 2b). At the hinged apex and the footing attachments 0.75-inch steel all-thread cut in approximately 14-inch lengths provides greater strength at these stress points. Appropriately sized washers are placed on all bolts prior to tightening and locking with two nuts.

Standard, inexpensive, 8-foot railroad ties buried at least 5 feet in the ground make excellent footings because of their size and treatment against decay (fig. 2c). Redwood or cedar 2 by 4's of variable length can be predrilled and bolted to the upward extensions to form a simple framework for raising the nest, attaching branches, and/or constructing a shade screen (6-foot uprights and a 10-foot cross piece were used on the prototype, fig. 3). For attaching perch branches 0.25-inch all-thread in sufficient lengths is bent into the form of a large U-bolt. A 1- by 8-inch metal plate drilled with a series of holes makes a suitable base plate and allows for some width adjustment in the field. At least two such bolts are required per perch branch. U-bolts are an alternative method of attaching the 2 by 4 framework. One-inch mesh chicken wire is needed for bundling sticks to be tamped into the apex and also for holding the nest or nest materials when raising and wiring into place. Tie wire is satisfactory for the latter task and can also be used as an alternative means of holding perch branches in place. The aluminum pipe must be treated with zinc chromate primer before painting. The prototype was colored a desert tan and then later camouflaged with green and brown spray paint.

Table 1 provides a complete list of all materials needed. Special equipment required for construction beyond the obvious power tools, wrenches, etc., include a portable generator for drilling the footing bolt holes in the field, at least a 36-foot extension ladder for accessing the apex once the tripod is upright, and post hole diggers for setting the footings.

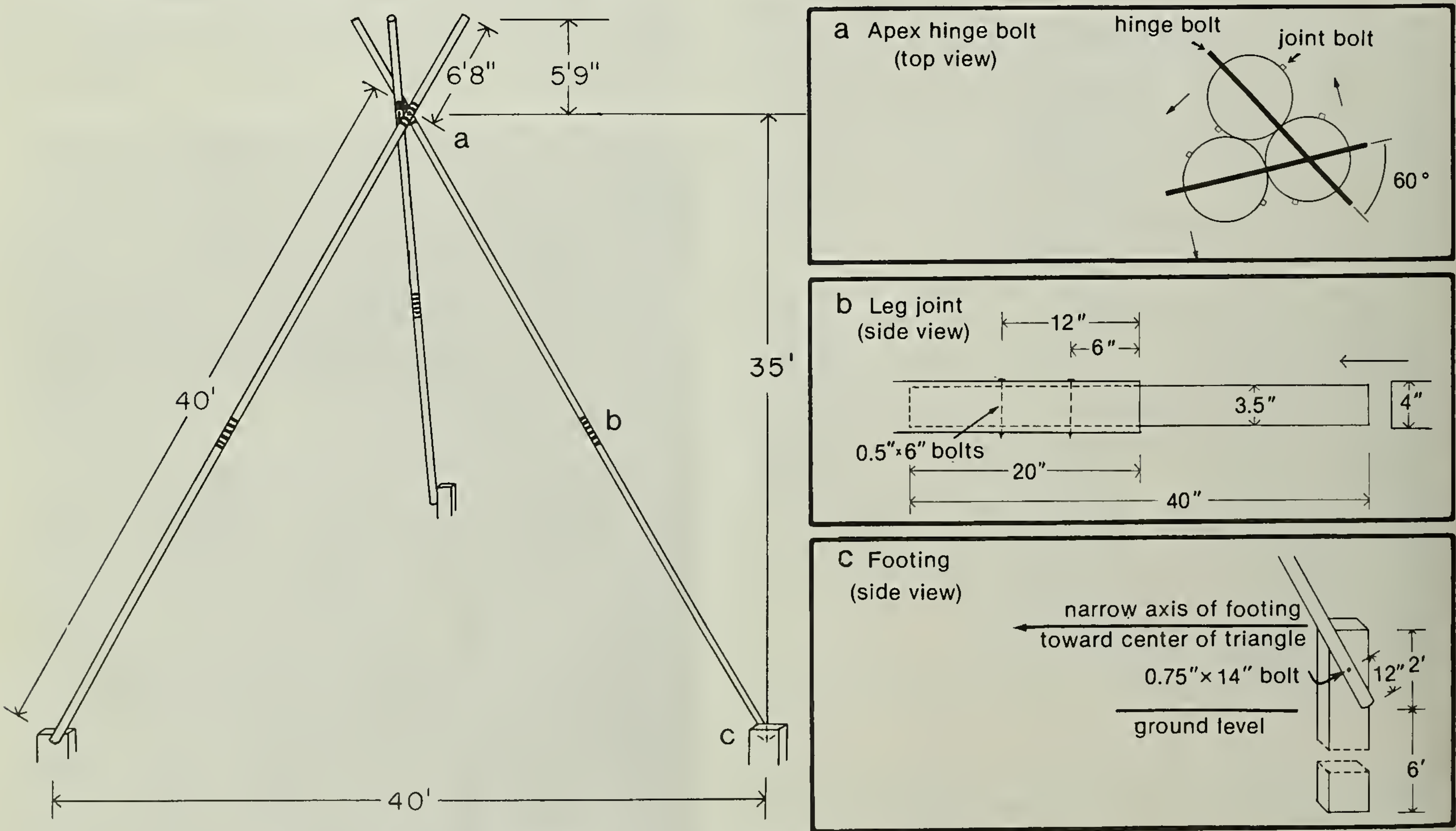

Figure 2.—Schematic of the nesting tripod showing dimensions and joints. (a)—Top view of tripod legs showing placement of hinge bolts. Arrows indicate direction of movement of upward extensions above pivot points when the legs are spread. Joint bolts are placed in the planes shown to avoid obstructing the legs' free movement. (b)—Schematic of the leg joints. (c)—Schematic of footing attachment.

Methods

In developing the prototype, a model of 0.5-inch dowling was constructed to determine the joint and hinge bolt angles necessary to allow the legs to swing free once upright. This design places the apex joints so that the three legs can be assembled and joined on the ground, raised simultaneously, and when spread into place, provide symmetrical nest support (fig. 2a). The model also proved useful for checking construction and positioning in the field. Assembly of a model before actual construction is strongly recommended for both planning and troubleshooting.

The aluminium pipe should be fitted and drilled in the shop. A drill press is best for this operation, but a 0.5-inch, hand-held power drill can be used. Bolt holes must be aligned so the protruding bolt heads will not interfere with the completed legs' movement when spread into place (fig. 2a). All pieces and holes should be labeled to facilitate proper fit and field alignment. Only the holes for the footing bolts are left for on-site drilling, to allow the weight of the structure to rest on the ground before the legs are secured to the footings. The pipe should be painted before leaving the shop, but extra spray paint in the field is usually required for touch up and camouflaging any wood framework attached after assembly.

Once on site the tripod legs are assembled and hinged loosely with two, 0.75-inch pieces of all-thread at 40 feet. The footings are buried at the points of a 40-foot equilateral triangle, oriented so the completed structure will have two upward extensions forming a plane facing south or

Figure 3.—Superstructure of the nesting tripod showing apex joint, 2 by 4 framework, perch branches, and nest materials.

Table 1.—Material list for constructing basic bald eagle nesting tripod

Item	Quantity
Aluminum pipe, 0.25-inch wall thickness	
4.0-inch inner diameter by 20 feet	7
3.5-inch inner diameter by 20 feet	1
Railroad ties, 6 inches by 8 inches by 8 feet	3
Steel bolts, 0.5-inch diameter by 6 inches	24
compatible nuts	48
compatible flat washers	48
Steel all-thread, 0.75-inch diameter by 14 inches	5
compatible nuts	20
compatible flat washers	10
Paint	
zinc-chromate aluminum primer	1 gallon
base paint (brown, green, or gray)	1 gallon
green spray paint	2 cans
brown spray paint	2 cans
Chicken wire, 1-inch mesh, 6-foot width	20 feet
Tie wire, 14 gauge	1 roll
All-thread, 0.25-inch diameter by 18 inches	6
compatible nuts	12
compatible locking washers	12
Flat metal plates, 1 inch by 8 inches	6
Optional 2 by 4 framework, cedar or redwood	
10-foot length	1
6-foot length	2
bolts, 0.5-inch diameter by 7 inches	4
bolts, 0.5-inch diameter by 4 inches	2
compatible nuts	12
compatible flat washers	12

southwest. This allows construction of a sun shade between those arms if necessary (fig. 4). In areas of high winds, a similar procedure could be used to locate an effective wind screen. A helicopter with a payload of at least 700 pounds (the assembled tripod weighs about 675 pounds) is recommended for raising the tripod and lifting the legs sufficiently off the ground for them to be spread to the footings. An alternative method of raising the tripod by hand (or vehicle) with lines, winches, and a boom is also considered feasible. Before drilling and bolting to the footings, the legs once upright can easily be positioned by two men. To avoid binding and hinge damage, it is important to spread the tripod legs as shown in figure 2a (i.e., above the apex, the upward extensions swing counter-clockwise, while the longer legs below open clockwise). Color coding the legs and their respective footings with spray paint is recommended to facilitate proper leg placement.

The apex bolts must be tightened after the legs are secured to the footings. A helicopter can be used to place a bundle of sticks wrapped in chicken wire into the apex to provide a platform for the nest, which can be raised in a similar fashion. These tasks can also be accomplished by bolting two 2 by 4's and a cross arm to the upward extensions and using a pulley and ropes to raise the materials. Care should be exercised to place the cross arm high enough above the apex to permit the nest to swing in freely over the top of the initial stick bundle. This framework

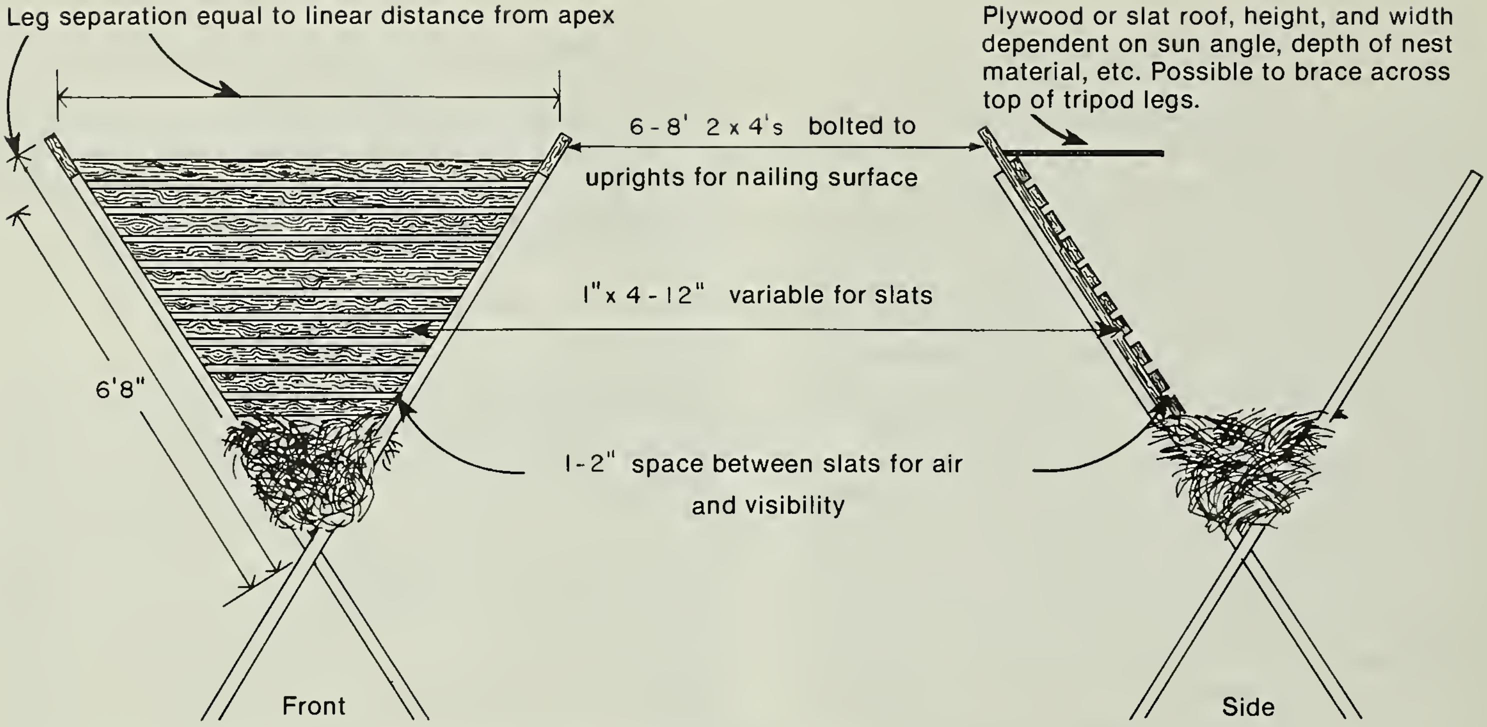

Figure 4.—An optional, untested, sun-wind screen for the bald eagle nesting tripod.

can be left in place as a perch support and a working surface for a sun or wind screen. A third method involves securing chicken wire in the apex and adding sticks until a suitable nest is achieved. The chicken wire support for the sticks and nest permits wiring them securely to the tripod legs. The last step is to bolt (or wire) a large perch branch to each of the upward extensions. On the prototype, 10- to 12-foot, dead branches already dried and thus relatively light proved satisfactory for this purpose (fig. 3). Four-inch plywood discs can be glued to the open ended pipes to prevent any accumulation of debris that might hinder future bolt adjustments.

Discussion

Wood originally appeared to be a more economical and natural material for the tripod legs, but the 1,100-pound weight of a single, 50-foot telephone pole was prohibitive. A sun or wind screen was not included on the prototype structure because the old nest tree it replaced offered no such protection, other than the branches that were used on the tripod. A screen can easily be added at the time of construction or any time thereafter (fig. 4). One consideration is that the branches alone appear more natural. Another modification that did improve the "naturalness" of the prototype structure was camouflaging the legs with dark brown and green spray paint. The original tan color blended well with the desert landscape but did not hide the straight line of the legs. The tripod was much less conspicuous when camouflaged. At the apex, construction might be facilitated by the addition of a disc platform or 2 by 4's bolted just above the 40-foot joint. These would provide a foothold for a worker and support for both the first bundle of sticks and the nest.

The cost of the tripod materials, including about an hour of helicopter time, is estimated at $1,200. The actual cost of the prototype was less than $900, but helicopter time was negligible; only 10 minutes were required to stand the tripod upright. Also the aluminum, which comprises the major portion of the cost, has risen to about $135 per 20-foot section of 4-inch pipe as priced in 1979. Approximately 150 man-hours were required for site preparation, shop work prior to field assembly, and actual construction of the prototype structure. Site preparation requirements will vary with location, but the time necessary for tripod construction should be less than 80 man-hours on future projects. It should be noted, however, that depending on how the structure is raised, 6 to 12 people are needed briefly to handle guy lines, spread the legs, etc.

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