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Sprig delivery by Broad-winged Hawks.—Adults of many species of nest-building Falconiformes place fresh green sprigs on their stick nests (Wimberger 1984). Although numerous functions for greenery on nests have been proposed (Olendorff 1971, Newton 1979), there are few published accounts of sprig delivery, and these records are based primarily on incidental observations. This report provides details of sprig delivery by Broad-winged Hawks (*Buteo platypterus*), and supplements previous observations (Burns 1911, Matray 1974, Bush and Gehlbach 1978, Rosenfield 1982).

Methods.—The study was conducted during the 1981 and 1982 breeding seasons in Allegany and Garrett counties, Maryland. Study sites and Broad-winged Hawk nest-site habitat are described in Titus and Mosher (1981).

We used a 15–60× spotting scope, and monitored sprig deliveries from blinds at three nests from 11 days posthatch until nestlings first left the nest (31–33 days). Hatch dates (±24 h) were known at one nest, and an age-estimation model (Lyons and Mosher 1983) was used to determine the age of nestlings at two nests. Observation periods of 275 min were randomly prescheduled between 06:00–21:00.

We distinguished individuals of a mated pair either by the presence of blue dye on breast feathers or by naturally occurring plumage characteristics. The sex of birds was determined by comparing observed parental behavior with that described by Matray (1974), who sexed trapped birds according to the presence or absence of a brood patch.

In addition to these observations, eight nest trees each were climbed from 1–12 times (47 total visits) from late incubation to fledging in 1981, and the presence of fresh greenery in nests was recorded. Twelve different nests each were visited 1–13 times (66 total visits) over

the same period in 1982. When fresh greenery was present we recorded species of sprig tree and percent of the nest cup covered by fresh greenery. Sprigs were designated "fresh" if leaves were green and could be folded without creasing or breaking. Nest observations were made by DML.

Results and discussion.—Fresh sprigs were observed at 39 of 47 (83%) and 49 of 66 (74%) of the nest visits in 1981 and 1982, respectively. Only one of 20 nests did not contain greenery, and this nest was visited only once. At six nests (visited both before and after hatching) the percent of the nest cup covered by fresh greenery during the 2-week period after all eggs hatched ($\bar{x} = 59 \pm 8$ [SE]) was not significantly greater (one-tailed sign test, $P = 0.344$) than that observed in the last 2 weeks of incubation ($\bar{x} = 43 \pm 17$).

Twenty-four posthatch sprig deliveries were recorded at three nests that were watched for a total of 128.3 h (28 observation periods). Adult females made all 24 sprig deliveries, as well as 14 of 18 posthatch deliveries of leafless twigs. This is in accord with observations that females are primarily responsible for nest construction by raptors (Olendorff 1971).

Sprig delivery rates did not change appreciably until 26 days posthatch, when delivery rates abruptly declined. We encountered very little fresh greenery in nest visits during the fourth week, when old accumulated greenery was as deep as 5–7 cm in the center of some nests. The decline in sprig delivery was associated with a decline in adult female attentiveness at nests. By the fourth week, the young were feeding themselves, and parents remained at nests for only brief periods to deposit food. Nestlings fought over food at this time and frequently pursued adults returning to the nest. The risk of injury during encounters with young at the nest (Jenkins 1978) may have inhibited sprig delivery during this period.

Prior to 26 days posthatch, seven sprigs were delivered in 36.6 h of observation from 06:00–11:00 (0.19 sprigs/h), 14 sprigs were delivered in 34.9 h of observation from 11:00–16:00 (0.40 sprigs/h), and one was delivered in 20.2 h of observation from 16:00–21:00 (0.05 sprigs/h). Thus, approximately 3.2 sprigs were delivered to a nest per day. If this daily rate continued from hatching to 26 days posthatch, an average of 83.2 sprigs would be delivered to a nest during the nestling period. Matray (1974) counted 65 and 54 sprigs in two nests at four weeks posthatch.

Sprigs from six species of trees were found in a total of 49 visits to 11 nests in 1982. Most nests contained sprigs from two to four species, although on seven consecutive visits, one nest contained only black locust (*Robinia pseudoacacia*) sprigs. Burns (1911) stated that only one species of sprig was used in individual nests, but Matray (1974) reported as many as five species in a single nest.

Twice we observed sprig collection by one adult. The female grasped a sprig in her beak while perched on a branch, tugged it free, and carried it to the nest in her beak. Both collection sites were in overstory trees within 25 m of the nest.

Birds usually placed greenery on the nest rim or cup with little effort to incorporate sprigs into the nest. Most sprigs were simply dropped on the nest, but birds sometimes spent several minutes moving sprigs about in their beaks. Occasionally a sprig was dropped on top of nestlings. Previous observers have suggested that sprig delivery serves to hide nestlings from predators (Criddle 1917) or to shade nestlings from the sun (Bush and Gehlbach 1978). Nestlings, however, were partially covered by sprigs in only 4 of 24 deliveries we observed.

We observed small amounts of greenery in partially completed hawk nests shortly after onset of nest construction. The nest-sanitation hypothesis (Orians and Kuhlman 1956) does not explain the presence of greenery in nests during this period of the breeding season. Similarly, territorial advertisement (Newton 1979) is an insufficient explanation for sprig delivery as greenery is delivered to nests containing eggs or nestlings, which readily indicate territorial occupancy.

Clark and Mason (1984) presented empirical evidence supporting an ectoparasite-repellent

function (Wimberger 1984) for nest greenery. Our observations suggest an additional function. Decaying greenery fills gaps between twigs, consolidates the nest structure, and may lengthen the period during which a nest remains in a tree (Newton 1979). Greenery use is significantly correlated with nest reuse in Falconiformes (Wimberger 1984). A long-term nest maintenance function would be useful to birds that reused nests in successive years as they may spend less time and energy refurbishing an old nest structure, and could begin laying eggs earlier than pairs that build entirely new nests. Early egg-laying pairs generally have greater reproductive success (Newton 1979).

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