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PIED CURRAWONGS AND SEED DISPERSAL

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Pied Currawongs congregate around the city of Armidale, New South Wales, in autumn and winter. Five observation periods showed that Pied Currawongs fly a regular route from a roost in the Armidale State Forest to town feeding areas. Birds fed extensively on berries of many ornamental and hedge plants during the day and returned to the roost in the late afternoon. Pied Currawongs regurgitate undigested material including seeds. Viable seeds of *Pyracantha* and *Crataegus monogyna* were recovered from regurgitated pellets. The implications of this diurnal movement is discussed with respect to seed dispersal.

The literature concerning Pied Currawongs *Strepera graculina* (Cracticidae) is somewhat scant and disjointed, dealing with behaviour, seasonal movements, diet and longevity (Lea and Gray 1936; Walsh 1965; Strong 1966; Readshaw 1968; Wimbush 1969; Recher 1976; Buchanan 1978; Nicholls and Woinarski 1988). Pied Currawongs live in tall eucalypt forests (Wimbush 1969) and move into areas of human habitation during the colder months (Readshaw 1968; Wimbush 1969). This movement may be related to changing food resources during the cooler months when insect abundance is low (Readshaw 1968; Wimbush 1969).

Pied Currawongs are resident in the Armidale region on the Northern Tablelands of New South Wales. Large flocks of Pied Currawongs congregate around Armidale in autumn and winter. They fly into town early in the morning and feed prodigiously on berries or garden ornamental and hedge shrubs and regurgitate undigested material, including intact seeds. In the afternoon the birds fly out of Armidale along numerous paths to the west, north and east. This paper examines one of the winter flight paths of Pied Currawongs north-east of Armidale and the significance of this for seed dispersal of introduced woody plants.

METHODS

Observations of feeding behaviour were carried out at various locations around Armidale. All flight observations were made in the Armidale State Forest (ASF), situated approximately 5 km north-east of the Post Office (Fig. 1). The forest was gazetted in 1915 and comprises an area of 247 ha. Elevations range from 960 m to 1 010 m, with a mean annual precipitation of 793 mm and average daily minimum and maximum temperatures of 7.3° and 20.3°C respectively (Forestry Commission of N.S.W. 1982). *Pinus radiata* is the dominant plantation tree in ASF, with other occasional pines and introduced hardwoods. There are remnant native trees, which include *Eucalyptus blakelyi*, *E. dalrympleana*, *E. viminalis*, *E. nova-anglica*, *E. bridgesiana*, *E. melliodora*, *E. caliginosa*, and *Angophora floribunda*. Occasional shrubs, including *Bursaria spinosa*, *Prunus mahaleb*, *Crataegus monogyna*, *Pyracantha angustifolia*, *P. rogersiana*, *Ligustrum lucidum*, *L. sinense*, and *Rubus fruticosus*, occur throughout the forest.

Observations were made on the mornings (0600–0730 h) of 31 July and 4 August and the afternoons (1600 1730 h) of 28 and 29 July

and 3 August 1988. The total numbers of Pied Currawongs flying overhead during consecutive five minute periods were recorded. Incoming flight directions at the observation point (Fig. 1) were assigned a sector, numbered clockwise from north, 1 to 8, each covering an angle of 45° (Fig. 2).

Diet preferences were assessed subjectively from observations of feeding and inspection of regurgitated pellets collected around the district, including ASF, throughout autumn and winter.

Viability of regurgitated seed of *Pyracantha* spp. was gauged by placing moist pellets in plastic bags for 2–3 weeks and recording if germination occurred. Various methods were used to establish viability of *C. monogyna* seeds. These included tetrazolium topographical test, visual inspection of incubated excised seeds and germination (Ellis *et al.* 1985). Seventeen *C. monogyna* seeds were tested with 1 per cent tetrazolium solution following Ellis *et al.* (1985). Thirty excised seeds were inspected for soundness and then were placed on wet paper which was rolled and placed into a plastic bag for trial germination. Ungerminated seeds were inspected for physical deterioration.

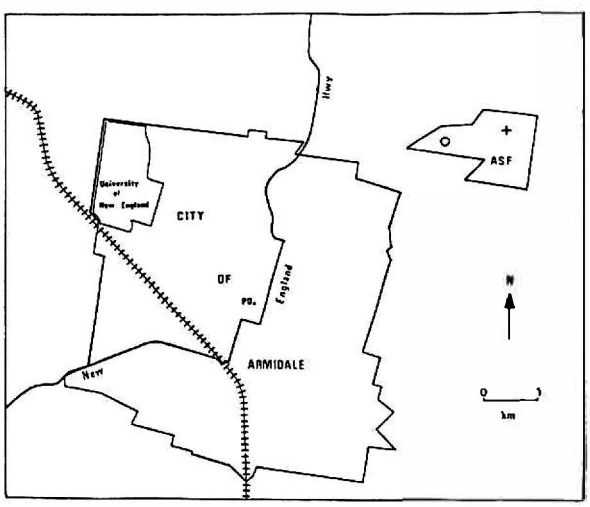

Figure 1. *Map showing the city limits of Armidale, location of Armidale State Forest (ASF), observation point (o) and roost (+).*

RESULTS

Flight patterns

Figure 2 shows the breakdown of flight directions and bird numbers for the five observation periods. In the morning Pied Currawongs flew towards Armidale from a north-easterly direction (sectors 1 and 2), with most leaving ASF between 0615 and 0625 h. Birds arrived at ASF from a south-westerly direction (sectors 5 and 6) between 1655 and 1720 h, with no currawongs observed after 1725 h.

On three separate afternoons Pied Currawongs were followed to their roost (Fig. 1). There they congregated in a dense stand of *P. radiata*. Many perched on the extreme tops of the trees and called loudly, possibly as a guide to other birds. As darkness fell the birds moved down into the pines and perched approximately 10–15 m above the ground. No nests were observed.

Diet and feeding behaviour

Pied Currawongs were observed feeding on fruit and occasionally invertebrates, from late March through to September. The fruit eaten were mainly *P. angustifolia*, *P. rogersiana*, *C. monogyna*, *L. lucidum* and *L. sinense*. Fruits were ingested whole and after 5–15 minutes undigested pulp and seeds were regurgitated as pellets, approximately 5 cm long and 2 cm in diameter. *Pyracantha* spp., with yellow, orange or red fruits, were the first to be eaten (March–April) and formed the major part of the winter diet of Pied Currawongs. Whole shrubs were stripped of fruit, but some shrubs retained fruit until early summer. Red *C. monogyna* fruits were eaten in small quantities from April to early July, with many shrubs retaining fruit until summer. *Ligustrum* spp., with black fruit, were significant for only a relatively short period around June, with fruit on isolated trees eaten sporadically until August.

Pied Currawongs fed in flocks of four or five to about a hundred. Fruit were first taken from the uppermost branches, and lower fruit was eaten later in the season. The birds ate 20 to 40 fruit, flew to nearby trees, telegraph poles or houses 5–10 m away, rested and then regurgitated pellets. Some birds flew 100–300 m before regurgitating pellets. Fresh pellets containing *Pyracantha* seeds were collected from ASF long after the forest *Pyracantha* were stripped of fruit.

Seed viability

Of 25 pellets with exclusively *Pyracantha* seeds, all contained germinating seeds. All 17 *C. monogyna* seeds tested with tetrazolium were deemed viable. Germination of *C. monogyna* was an unsatisfactory method as *C. monogyna* seeds display dormancy and this can take up to six months to break (Ellis *et al.* 1985). Some germination of *C. monogyna* was achieved, however most seeds did not germinate. Ungerminated seeds were assessed physically and 21 proved to be sound (Ellis *et al.* 1985).

DISCUSSION

The movement of Pied Currawongs to areas of human habitation during the cooler winter months (Readshaw 1968; Wimbush 1969) is likely the result of a shift in diet from abundant invertebrates in summer to fruit and human-generated refuse in autumn and winter (Wimbush 1969). This study revealed that Pied Currawongs flew into and out of Armidale in loose groups, along regular flight paths. Afternoon flight distances are affected by the amount of light. No Pied Currawongs were observed after 1730 h when conditions were dark. The roost area was constant from day to day, but flight directions altered as birds returned from different feeding areas. Using well located observation points over which Pied Currawongs converge, the method has potential for estimating winter Pied Currawong flocks if a number of flightpaths are simultaneously monitored.

During the day, the birds fed extensively on fruits of *Pyracantha*, *C. monogyna* and *Ligustrum* and to a lesser extent other plants. Germination of *Pyracantha* seeds indicated seed viability. Despite low germination of *C. monogyna* seeds, the tetrazolium viability test is regarded as a good indicator of viability (Ellis *et al.* 1985). For an animal to be regarded as a dispersal agent it must deposit seeds in a viable condition away from the parent plant. As such the results of viability testing show that Currawongs are capable of dispersing seeds. Buchanan (1978) indicated that Pied Currawongs also disperse *Ligustrum* seeds. In ASF there are many wild *Pyracantha*, *C. monogyna* and *Ligustrum* growing under or near pine trees and remnant eucalypts, which suggest dispersal by birds. These plants probably

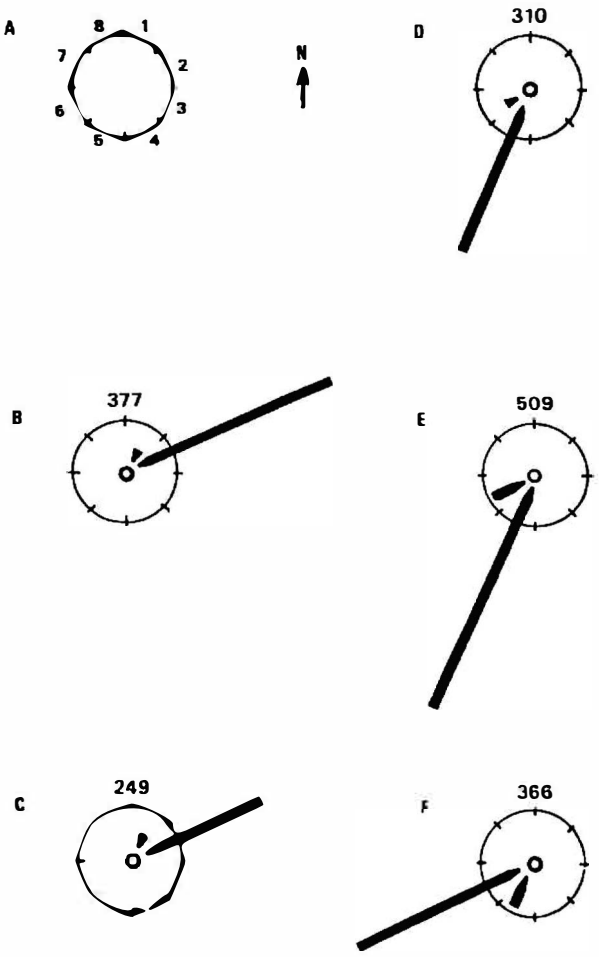

Figure 2. *Breakdown of flight direction and numbers of Pied Currawongs observed over ASF. (A) shows sector numbers. (B) and (C) are morning flights out of ASF on 31 July and 4 August respectively. (D), (E) and (F) are afternoon flights into ASF on 28, 29 July and 3 August respectively. The centre of each circle represents the observation point. Numbers for B–F refer to total numbers of Pied Currawongs observed in each time period and the length of lines are proportional to numbers of birds for each sector.*

originated from gardens and hedges in Armidale. Fresh pellets containing *Pyracantha* seed were found throughout ASF after all the local *Pyracantha* were stripped, indicating that these seeds had come from outside ASF. Therefore Pied Currawongs are capable of dispersing seeds over many kilometres.

The combination of established, relatively constant flight paths and dispersal of seed by Pied Currawongs results in a continual rain of seed, in the form of regurgitated pellets, during the winter over ASF and nearby areas. As the distribution and abundance of 'escaped' ornamental and hedge plants increase, the winter food resources also increase, and in turn may support an increased Pied Currawong population (Mulvaney 1986). *Pyracantha* spp. are the major winter food for Pied Currawongs in Armidale and as such their seeds are widely dispersed in and around Armidale. *C. monogyna* shrubs often keep their fruit until summer and do not provide a major portion of Pied Currawong winter diet in Armidale, but may be an important food reserve for harsh winters and sudden cold periods in spring. Fruits of other woody species are ingested to a lesser extent but may become more significant in the future.

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COLONIAL NESTING OF STRIATED HERONS AT TUGGERAH, NEW SOUTH WALES

Standard reference texts state that the Striated Heron *Butorides striatus* (a) normally nests solitarily but occasionally colonially (Hancock and Kushlan 1984); (b) nests solitarily in mangroves but gives one record of colonial nesting at Port Essington, Northern Territory (Blakers *et al.* 1984); (c) nests (solitarily) in mangroves or similar leafy cover 3–9 m above water (Pizzey 1980); (d) nest (solitarily) in fork in mangrove or other swamp trees up to 10 m (Macdonald 1973); and (e) nest solitarily in mangroves (Slater *et al.* 1986). Therefore an apparent successful colonial nesting attempt at Chittaway Point, Tuggerah Lakes, on the New South Wales Central Coast, warrants further details.

The Chittaway Point (33°20'S., 151°05'E.) nesting site was located in Swamp-oak *Allocasuarina glauca* swamp forest, which has an understorey of the Common Reed *Phragmites australis*. Except for the dry period during October 1988 very shallow water has been present in the swamp most of the time the colony has been under observation. The wetland is located on the northern bank of Ourimbah Creek, forming part of the delta of the creek where it enters Tuggerah Lakes. The three nests in the colony were located among nine Little Egret *Egretta gazetta* nests, the latter breeding colony having been located here since 1982 (Lindsey 1985). All Striated Heron and Little Egret nests were located in Swamp-oaks, even though one Grey Mangrove *Avicennia marina* and several Norfolk Island White Oak *Lagunaria patersonia* were in close vicinity.

The three Striated Heron nests were found over a three month period, but this was because colonial nesting was not expected so no special effort was made to search for nests. Details of each nest are as follows:

Nest A: Located 1 November 1988 3.4 m above ground, against and under a bend in the main trunk. Nest platform consisted entirely of Swamp-oak twigs and measured 33 x 18 cm, depth of cup 4 cm, total depth of platform 19 cm.