# Ornithology from the Tree Tops

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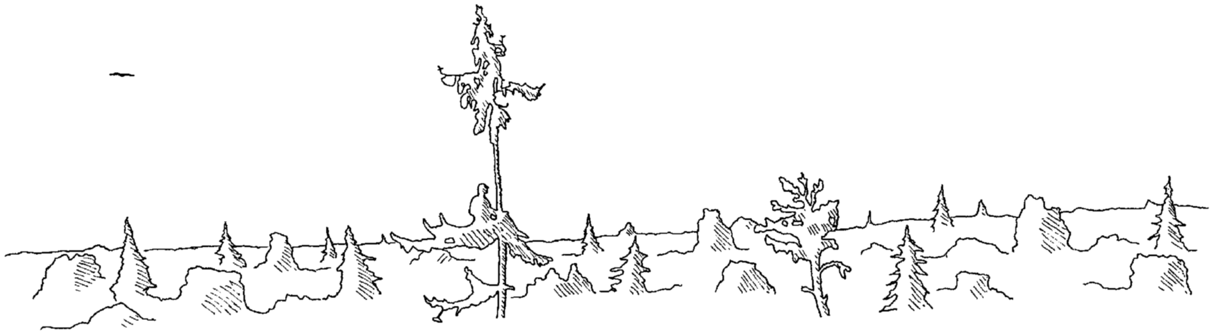

# Ornithology from the tree tops

## Insect declines versus forest birds

December 1874, a storm is heading towards the Sierra Nevada. John Muir, exploring one of the tributary valleys of the Yuba River, lost no time in pushing out into the woods to enjoy this 'most beautiful and exhilarating' phenomenon. It occurred to him that it would be a fine thing to climb one of the trees to obtain a wider outlook and get his ears close to the Æolian music of its topmost needles. He kept his lofty perch in a tall Douglas Fir for hours, embracing the top like a Bobolink on a reed.

The happy few still climb trees to gain a wider outlook from the top, not so much spurred by romantic feelings but, more prosaically, to track Honey Buzzards *Pernis apivorus* transporting prey towards an as yet undiscovered nest. An additional advantage of a 'lofty perch' is reflecting on what many others fail to see. Take, for example, chironomids, that vast army of nematoceran flies. During the hours' long stay in a tree top nobody can fail to notice the swarms of dancing mosquitos, swaying in the light breeze and orienting themselves windward in order to maintain their position relative to the swarm marker. A magic sight, especially with many swarms in view of the tree topper. That insect might is no more.

Something is amiss in the six-legged kingdom. Until the recent hullabaloo in the media the insect decline was a non-entity among the public. It takes chance, or perhaps a well-coined one-liner that strikes a chord with a journalist, to trigger a short-lived cascade of media attention. It remains to be seen what exactly the effect of the outcry on land management will be, especially in farmland. In the past, hard-core science led to bans on the use of DDT and mercury-based seed-dressings in farmland in western countries, but not elsewhere. Frustratingly, removal of this particular environmental threat was effectively nullified by the introduction of a multitude of other chemicals. The chemical giants are a hydra; cut off one head and it will spawn several more. Farming, forestry and industry are totally addicted to the use of chemicals, and this is not going to change despite overwhelming evidence of negative impacts of pesticides on insects (Forister *et al.* 2019). Even nature conservation societies use glyphosate in their futile attempts to eradicate invasive plants like *Prunus serotina* and *Fallopia japonica*. These plants are now so widespread that any hope of eradication is ludicrous. Besides, their impact on the invaded environment is multifarious and not just negative (Schilthuizen *et al.* 2016, Lavoie 2017).

Insect declines and changing insect phenologies have been recorded for many decades (Bell *et al.* 2015, Leather 2018, Bell *et al.* 2019, Sánchez-Bayo & Wyckhuys 2019). Research has been focused on farmland, with hundreds of studies explaining in painful detail what has happened to birds, plants, soil invertebrates and arthropods in a depauperated environment (MacLean 2010). The accumulation of past and extant monitoring schemes revealed that insect declines are vast indeed, not just in terms of biomass (Hallman *et al.* 2017) but also in numbers and in the number of taxa and species affected (Hallman *et al.* 2019, Seibold *et al.* 2019). Moreover, insect declines are not restricted to farmland. Insects in forests show severe declines as well, especially considering the short time span of the German study (2008–2017): 41% in biomass, 36% in species numbers but no significant change in abundance (–17%; Seibold *et al.* 2019; but see Moraal & Jagers op Akkerhuis 2013, who show disparate trends in the wake of changing forestry practices and climate). It should be born in mind that the 10-year decline in Germany is part of a much longer-lasting decline. My impression from the tree tops fits the bill: something is happening in the forest, on more than one trophic level.

Another advantage of tree-topping, apart from seeing what ground-dwelling bipedals overlook, is time for reflection. No place to go, after all. Pondering the insect declines in forests, it occurred to me that – for a decline of that size in such a small time interval – the

The observer in a tree top used to see dancing mosquito swarms all over the forest, often towering above his own head, but those times are no more. Insects have declined dramatically, including chironimidae (photo Rob G. Bijlsma, Bokkenleegte, Drenthe, 23 September 2019).

impact on populations of insectivorous passerines is surprisingly small and contradictory, with increases ánd declines within families and within habitats. The Willow Warbler *Phylloscopus trochilus*, for example, shows a decline, whereas its close relative Chiffchaff *P. collybita* is increasing. And what about Goldcrest *Regulus regulus* (decline) compared to Firecrest *R. ignicapillus* (increase)? Why is European Nightjar *Caprimulgus europaeus* at the moment commoner than ever before in the past half century, when its steep decline in the 1970s and 1980s was cause for concern? This is especially counter-intuitive because breeding is largely confined to nature reserves, where insect declines in 1989–2016 amounted to 75% in biomass (Hallman *et al.* 2017). Among the insects adversely affected, moths are high on the list (review in Sánchez-Bayo & Wyckhuys 2019). Moths also figure prominently in diets of Nightjars: >80% of the food studied in the 2000s consisted of macro-lepidoptera (van Kleunen *et al.* 2007, 2012).

Are some moth species excluded from the overall downfall, and perhaps sufficiently abundant and available for Nightjars to increase fivefold between 1990 and 2018? Monitoring of insect outbreaks in Dutch forests since 1946 indeed revealed large shifts in the frequency of outbreaks of specific insect species, correlated with changes in forest composition (deciduous replacing coniferous), temperature in winter (higher, positively affecting Lepidoptera species wintering as egg) and life history strategies of the various insect species. The frequency of outbreaks for moth species inhabiting deciduous forest increased, but the opposite is true for species depending on coniferous forest (Moraal & Jagers op Akkerhuis 2013). In the same vein, the food of Nightjars on the Veluwe and in Noord-Brabant in respectively 2007 and 2008–2010 was dominated by noctuid species that were known to have increased (van Kleunen *et al.* 2007, 2012).

Nightjars, for which a lot of data are available, still present a puzzle in terms of diets and food availability versus trends, but what about passerines breeding in forests? Information on diets is almost completely lacking in a Dutch setting, except for Pied Flycatcher *Ficedula hypoleuca* (Burger *et al.* 2012) and to a lesser extent for Wood Warbler *Phylloscopus sibilatrix* (Bijlsma 2013, 2014). Both species showed a diverse diet, covering many insect taxa from a wide range of niches, and closely tracked seasonal and annual changes in the availability and abundance of arthropods. In the past decades Pied Flycatchers and Wood Warblers have, by and large, deserted deciduous forests as a breeding place in favour of breeding in mixed and coniferous forests (flycatchers breed in nest boxes, hence their story is a bit more complicated). Were they following shifts in food availability? Such adaptations may explain why at least some species do not suffer from huge declines in biomass and numbers of insects in forests. But what about the passerine species which are in decline? Are they less flexible in dietary choice, feeding on insects that show adverse trends? Or do declining passerines sooner reach a threshold in insect availability below which profitable foraging is impossible? And what about habitat changes, which have been vast in Dutch forests in the past half century? Not to mention Africa, of course, for the long-distance migrants.

Without basic monitoring of the natural world none of these worrying trends could have been quantified and presented to the public and governmental authorities. Vast insect declines tell us something about the environment that transcends insects: we are poisoning the living world on a massive scale. How exactly insect crashes cascade into higher trophic levels is less easy to elucidate, not least because profound environmental changes across the globe are working in concert. What is particularly worrying is not so much the fact that we

Typical nest of European Nightjar, the 11–12-day old chicks are surrounded by faecal sacs (white blobs) which can be used to investigate diet (photo Rob G. Bijlsma, Forestry of Smilde, Drenthe, 2 August 2017).

don't know everything, but rather that the vast knowledge available does not, or hardly ever, result in political decisions that address serious problems (Wilson 2001, Leather 2018, Forister *et al.* 2019). Perhaps scientists are too complacent and naïve. We need more outspokenness, more action following in the wake of science. Just producing papers will not do.

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