



# Building Resilience on Your Farm: Supporting Beneficial Birds and Managing Pest Birds

by Jo Ann Baumgartner, Sara Kross, Sacha Heath, and Shelly Connor

Birds may be helping you or your farm neighbor keep pest insects, rodents and pest birds at bay. When you provide habitat for beneficial birds and bring them closer to your crops, you may be able to reduce your pest-control costs. Beneficial birds can help with production in the same way as beneficial insects.

Pest birds seem to get most of the attention these days, but that wasn't always the case. Researchers in this country and around the world are partnering with farmers to use new science and build on more than 130 years of past studies. These partnerships help us understand the roles birds can play in pest control and the relatively few but significant bird species that are pests themselves.

Today farmers who are masters at IPM—Integrated Pest Management—are using ecological pest-control strategies that include birds. These growers understand that birds are trying to satisfy their own needs, not to help or harm crops.

We think of certain birds as beneficials or as pests, but some species switch roles, depending on the season, their life cycles and the food sources available. For these so-called turn-coats, farmers can support these birds in the beneficial phases, and co-exist with them at other times. Savvy growers manipulate habitat, altering cultural practices and timing to take advantage of the benefits some birds provide and discourage damage from pest birds.

The overwhelming majority of songbirds are beneficial during nesting season because they feed pest insects to their voracious nestlings. Many songbirds continue to be beneficial throughout the year, but some switch to more plant-based diets in the fall, congregate in large flocks and become “pests.”

But birds that consume fruit or nuts in season can later become beneficial to the farm again. In nut crops, for example, Ravens clean up the leftover “mummy” nuts that would otherwise harbor overwintering pests.



Sometimes the effect of birds goes beyond what they eat. While raptors certainly prey upon rodents or pest birds in agricultural fields, the raptors' mere presence can also create a fear response in their prey, which can reduce crop damage.

Not surprisingly, growers tend to know a lot more about the birds that cause damage than about those that are beneficial. Losses can be significant for some crops, but the benefits of the pest control services provided by birds have not often been measured. Agriculture has functioned with birds for thousands of years. Some crop loss is inevitable and can be tolerated when it falls below the economic threshold. Diverse functioning farms make tradeoffs. The multiple benefits of habitat that supports bird life should be weighed against the drawbacks. Every situation is different. Farmers are constantly setting priorities and adapting management practices to existing conditions.

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## Accounts of Birds in Farm Fields

The following accounts are from researchers investigating effects of birds in pasture and crops grown in the Continental US. These stories reflect recent and historical scientific studies, and are just the tip of the iceberg when it comes to bird-farm interactions.

Beneficial birds reduce pest insects, weeds, rodents, and pest birds. Creating and conserving habitat on the farm and in the surrounding landscape can support birds' pest-control efforts. Farmers are planting hedgerows and sunflower rows for habitat, and putting up nest boxes and perches to augment or replace habitat. The accumulation of these practices among growers, along with larger scale habitat conservation efforts of multiple stakeholders, increases the amount of habitat—and thus the number of birds that control pests—throughout agricultural landscapes. These accounts show that birds can reduce farm pests while increasing crop growth, yields, or cost-savings.

### Legend for Types of Birds' Diets

-  Omnivore
-  Insectivore
-  Carnivore
-  Granivore

[Full references and photo credits can be seen here.](#)

# Birds Consuming Pest Insects in Vegetables



## Hedgerows in Kale Increase Pest Control

**More Cabbage Looper caterpillars were consumed by birds near shrubby field margins than in other uncultivated areas.** On average, caterpillars to which birds had access were reduced by 24%.<sup>1</sup> Yet, results suggested when the pests numbers were low, birds were not as effective.

In two separate kale studies, birds were beneficial in reducing caterpillars near shade trees; did not reduce aphids' natural enemies;<sup>2</sup> and reduced aphids and their leaf damage three times more than when birds were excluded.<sup>3</sup>

<sup>1</sup> Garfinkel and Johnson 2015.

<sup>2</sup> Guenat 2014; <sup>3</sup> Ndang'ang'a et al. 2013.

## Natural Habitat Next to Cabbage Boosts Pest Control

**Shrubby field margins, riparian areas and forest edges influenced a higher rate of aphid control through a combination of natural enemy birds and insects.** Even though some birds consumed natural enemy insects, the overall effect on pest insects was beneficial for growers.<sup>1</sup>

In other cabbage studies, birds reduced more aphids in non-sprayed fields with higher abundance of the pests than in sprayed fields;<sup>2</sup> and reduced pest caterpillars by 49% in different fields.<sup>3</sup>

<sup>1</sup> Martin et al. 2015.

<sup>2</sup> Jadav et al. 2013; <sup>3</sup> Strandberg 1981.

## Pest Control Increased Plant Growth in Broccoli

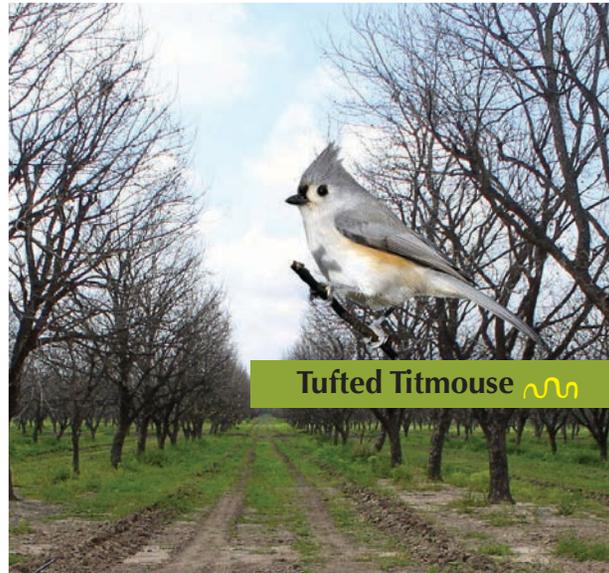
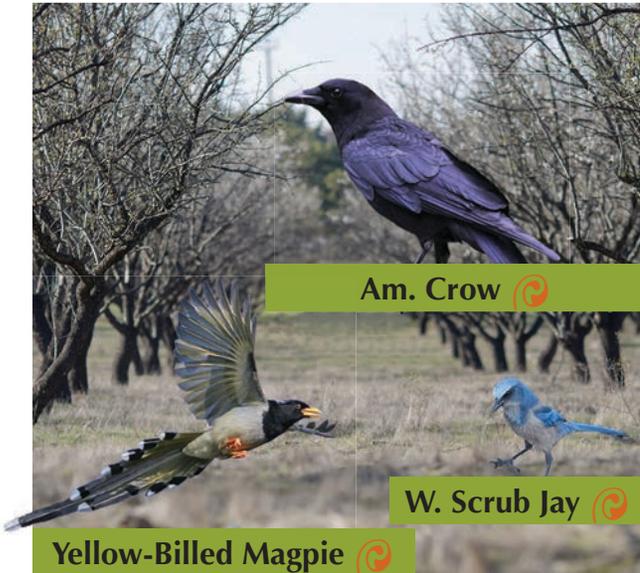
**Birds reduced densities of two damaging caterpillars, resulting in increased plant growth.** While other natural enemies were present, including spiders and parasitoids, birds were the most important predator.<sup>1</sup>

Another study reports birds increased aphids in broccoli by eating natural enemy insects later in the season, especially in simple landscapes. This did not impact yield, possibly because the late aphid leaf damage did not decrease head production.<sup>2</sup>

<sup>1</sup> Hooks et al. 2003.

<sup>2</sup> Smith et al. personal communication 2018.

# Birds Consuming Pest Insects in Nut Crops



## Edges, Habitat, and Co-Existence in Almonds Can Yield Net Returns

**Birds saved farmers on post-harvest costs of removing mummified almonds.** While they also consumed marketable nuts, there was a positive net return of AUD \$25–\$275/ hectare averaged across the orchards. More benefits occurred along orchard edges.<sup>1</sup>

In another study, birds, deer and rodents reduced Navel Orangeworm in organic and conventional orchards, more so in complex landscapes with higher proportions of natural habitat and a diversity of plants in the orchard understorey.<sup>2</sup>

<sup>1</sup> Luck 2014.

<sup>2</sup> Eilers and Klein 2009.

## Worthy Birds in Pecans

**Each Tufted Titmouse is estimated to be worth about \$2,900 to the pecan industry.** Based on stomach contents, observations show that each bird consumes 2,100 pecan nut Casebearer larvae, and that 25 nuts could be destroyed by the offspring of one overwintering female insect. 52,000 nuts<sup>1</sup> would be saved at today's prices.<sup>2</sup>

An earlier study looking at the contents of bird stomachs found that 64 bird species ate these pecan pests: weevils, scale, beetles, termites and caterpillars.<sup>3</sup>

<sup>1</sup> Whitcomb 1971.

<sup>2</sup> At 45 shell nuts in a pound and at \$2.50/pound.

<sup>3</sup> McAtee, W. L. 1915 (in Tedders, 1983).

## Walnut Orchards and Hedgerows Synergistically Support Pest Reduction

**Birds killed an average of 41% of overwintering Codling Moths in walnut orchards.**<sup>1</sup> Bark-gleaning bird species, such as woodpeckers and nuthatches, were the most prominent predators. Orchards with big old trees and hedgerow or riparian edges harbored more of these avian predators than young orchards with weedy margins. The amount of natural vegetation in landscapes surrounding orchards helped the most: Codling Moth consumption, mainly by birds, increased from 23–65% as natural vegetation increased from 0% to 38%.

<sup>1</sup> Heath et al, personal communication.

# Birds Consuming Pest Insects in Fruit Trees



## Habitat and Nest Boxes Influence Pest Control and Yields in Apples

Various studies reported that between 13% and 99% of overwintering Codling Moth in apple orchards were consumed by birds, especially near habitat.<sup>1</sup> When nest boxes were used to increase the density of Great Tits (a relative of chickadees), the apple yield increased by 66%.<sup>2</sup>

While pest birds cause damage, they often consume insects for part of the year (especially when raising their young), which can result in a net benefit, as one study showed.<sup>3</sup>

- 1 See Pest Insects in Apples in Appendix.
- 2 Mols and Visser 2002 and 2007.
- 3 Piesley et al. 2016.

## Ground-Foraging Birds Diminish Pest Insects in Pears

When Dark-Eyed Juncos are in large flocks of 50 to 150 birds, they consume large numbers of insects. From 23,000 to 70,000 Pear Psylla females, with a potential production of 7 to 23 million eggs, were removed from orchard duff by the birds.<sup>1</sup>

In 1927, stomach contents of Black-Capped Chickadees, Golden-Crowned Kinglets and Red-Breasted Nuthatches were found to contain large numbers of psyllas in winter. The chickadees were attracted to the farm using suet and seeds.<sup>2</sup>

- 1 Fye 1982.
- 2 Odell 1927.

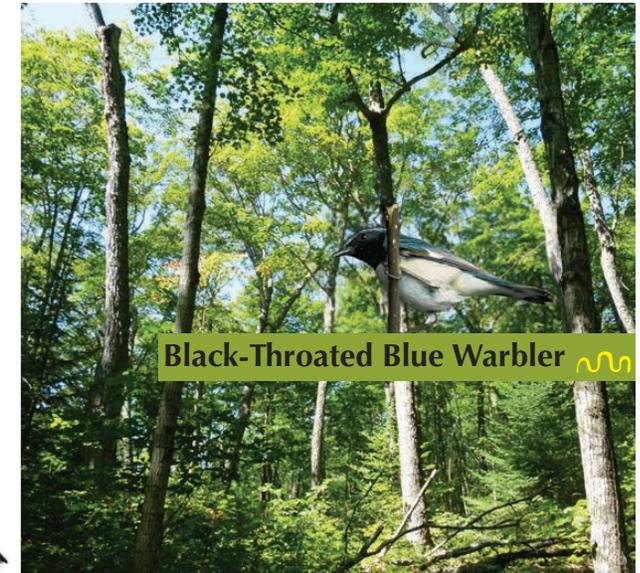
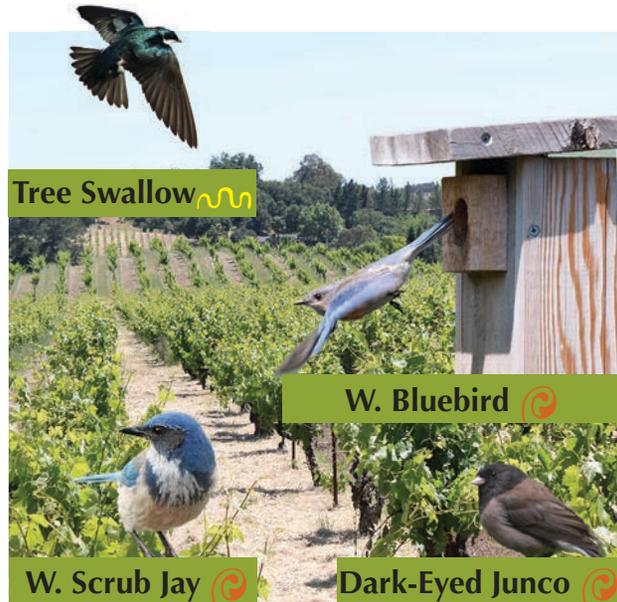
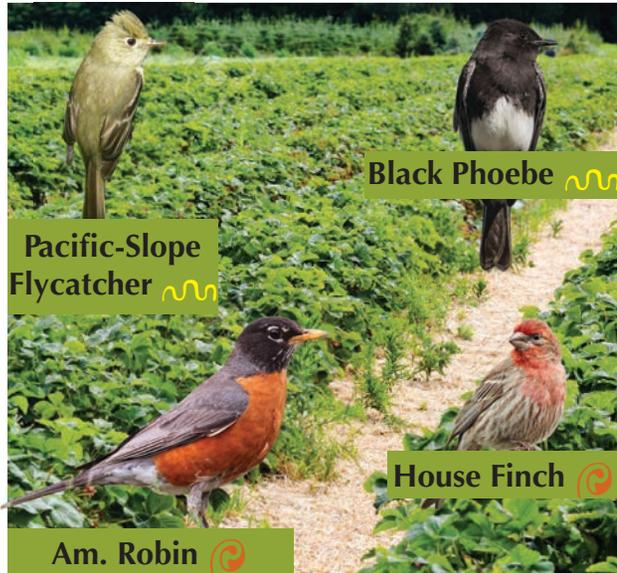
## Tree- and Ground-Foraging Birds Lessen Pest Insects in Olives

Birds help reduce Olive Fruit Flies in two stages: larvae in the fruit and pupae on the ground. The olive fruit that was eaten by the birds mostly contained larvae,<sup>1</sup> suggesting that birds do not have a negative impact on production.<sup>2</sup> Birds consumed 65–71% of the pupae in soil, and ants attacked most of the rest.<sup>1</sup>

In other research, birds were one of several important predators of the Olive Fruit Fly pupae along with ants, beetles and centipedes.<sup>3</sup>

- 1 Bigler et al. 1986.
- 2 Pienkowski and Beaufoy 2000.
- 3 Cavalloro and Delrio 1975.

# Birds Consuming Pest Insects in Fruit Fields and Maple Sugar Bushes



## Habitat in Strawberries Reduces Pest Bird Impacts

**Beneficial birds decreased Lygus Bug damage at about the same rate as pest birds damaged the strawberry crop.** Natural habitat in the surrounding landscapes and diversified farming practices promoted the most on-farm bird diversity. However, the highest abundance of pest birds was on farms surrounded by intensified agricultural landscapes. Farmers may benefit from diversifying farms in intensively farmed landscapes, and conserving semi-natural habitat at the landscape level.<sup>1</sup>

<sup>1</sup> Gontheir et al. 2018.

## Nest Boxes in Wine Grapes Increase Pest Control

**Nest boxes greatly increased the abundance of Western Bluebirds and their ability to reduce insects in the vineyards.** The highest removal of insects, 59%, was closest to nest boxes. DNA analysis of feces showed that birds were not consuming many natural enemy insects; only 3% were in their diet.<sup>1</sup>

In other studies, birds reduced insects about 33% more near nest boxes,<sup>2</sup> and they reduced up to 98% of insects on edges and interiors of vineyards.<sup>3</sup>

<sup>1</sup> Jedlika et al. 2011 and 2017.  
<sup>2</sup> Benayas et al. 2017.  
<sup>3</sup> Howard and Johnson 2014.

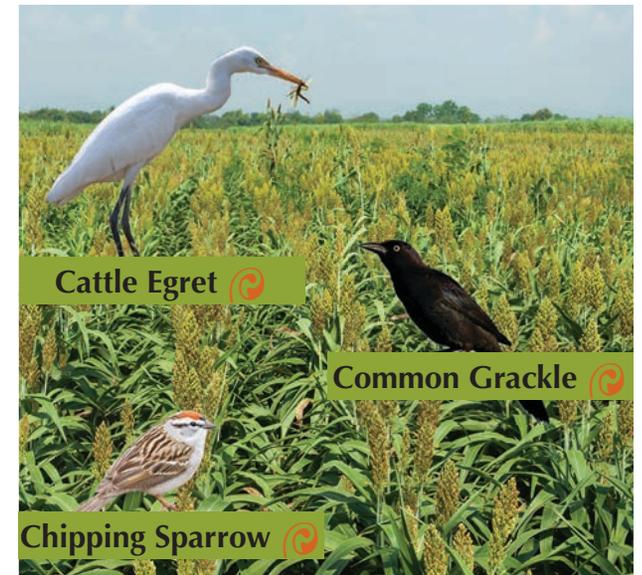
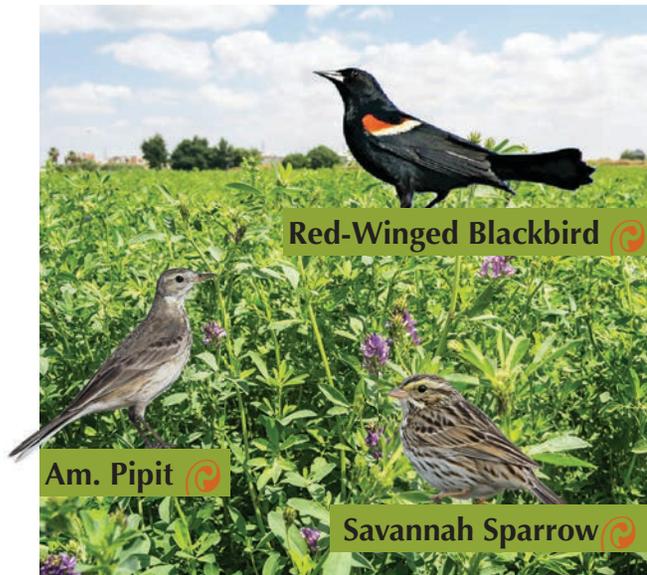
## Maple Syrup Is Doubly Sweet When Supporting Bird Biocontrol

**Birds reduced caterpillars by 17–37% over two years in maple forests.** Sugar maple leaf damage was 15–35% less in the presence of birds, but this did not result in increased biomass production in the following year.<sup>1</sup>

In 1897–1898, a severe outbreak of forest tent caterpillars damaged thousands of acres of sugar maples.<sup>2</sup> Large numbers of warblers and other birds arrived, and by 1900 injury was no longer seen. Audubon Vermont's bird-friendly label enrolls farmers in a marketing program to support bird conservation.

<sup>1</sup> Strong et al. 2000.  
<sup>2</sup> Forbush 1908.

# Birds Consuming Pest Insects in Field Crops



## Habitat Boosts Pest Control in Alfalfa

**Songbirds reduced Alfalfa Weevils by over 33% on average.** Fields with at least 2 trees along edges had over 13 species of birds, whereas fields with just weeds or dirt roads had only 5 species of birds. Increasing habitat greatly benefits over-wintering birds that provide pest-control services.<sup>1</sup>

Another study estimated that a flock of Swainson's Hawks ate 310,000 grasshoppers in 14 sq. miles of mostly alfalfa and corn, with adjacent small stands of trees.<sup>2</sup>

<sup>1</sup> Kross et al. 2016a.  
<sup>2</sup> Johnson et al. 1987.

## Habitat and Co-Existence in Corn Result in Pest Control

**Birds reduced corn insect pests by 34–98% in various studies.** Significant reductions in some cases were tied to nearby habitat patches that provided shelter for birds.<sup>1</sup>

Some of the beneficial birds were later pests. Co-existing with birds when they are beneficial, such as Red-Winged Blackbirds when they glean insects during corn's silking phase, can benefit the farm. Later in the year, management practices can be used to discourage their presence.<sup>2</sup>

<sup>1</sup> See Pest Insects in Corn in Appendix.  
<sup>2</sup> Dolbeer 1990.

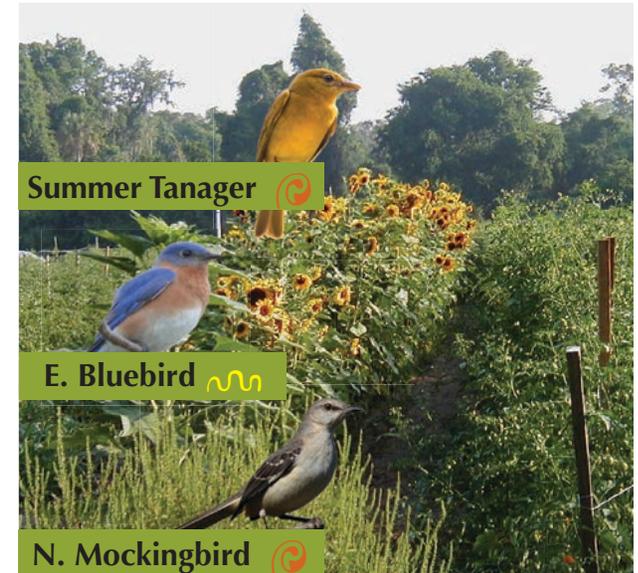
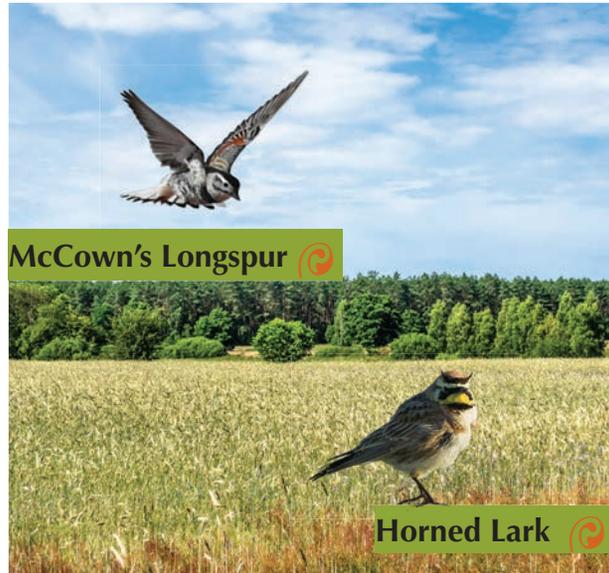
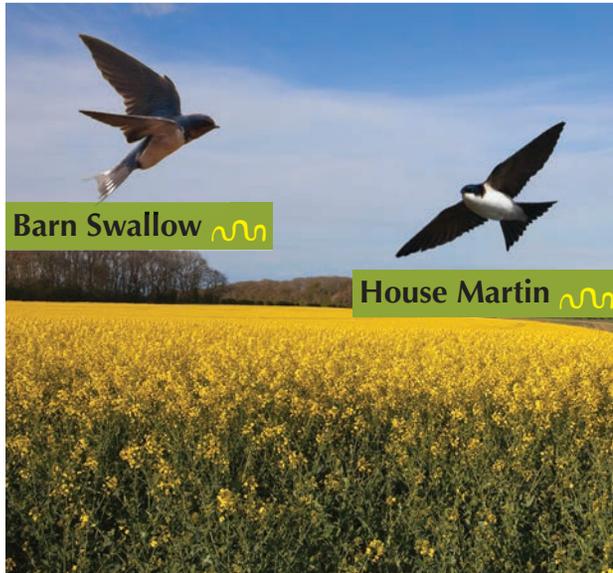
## Modeling in Millet Predicts Pest Control

**Birds were predicted to account for a reduction of 20–26% of grasshoppers in millet, according to modeling studies.** This bird predation was estimated to reduce the following season's insect egg production by 34%.<sup>1</sup> Modeling helps make predictions based on previous findings.

In 1916, the examination of the stomach contents of more than 40 bird species present in millet and other grain crops contained evidence of the pest Armyworm.<sup>2</sup>

<sup>1</sup> Axelsen et al. 2009.  
<sup>2</sup> Walton 1916.

# Birds Consuming Pest Insects in Field and Mixed Crops



## Birds Help Curtail Pest Insects in Oilseed Rape

**Examination of fecal sacs collected under active cavity and mud nests of aerial insect-eating birds contained 18–84% of pest insects.** Some of these birds consumed the pest insects before the crop was harvested, as well as afterwards, impacting general pest populations.<sup>1</sup>

Another study found birds helped reduce oilseed rape pests, but were not be as important as other natural enemies. Bird presence was related to tree cover.<sup>2</sup>

<sup>1</sup> Orłowski et al. 2014  
<sup>2</sup> Lemessa et al. 2015.

## Co-Existence and Complex Landscapes Influence Pest Control

**Birds shown above had 34–70% incidence of mostly cutworms in their stomachs, with the rest being wheat, grass and forb seed.** Both species feed only insects to their young. In other studies bird predation on Corn Earworms in wheat was 34%, and on aphids was highest in organic wheat fields within complex natural landscapes.

Different research found no bird predation of aphids, possibly due to lack of bird perches. One study showed birds increased aphids by eating natural enemy insects, possibly because they were larger than aphids.<sup>1</sup>

<sup>1</sup> See Pest Insects in Wheat in Appendix.

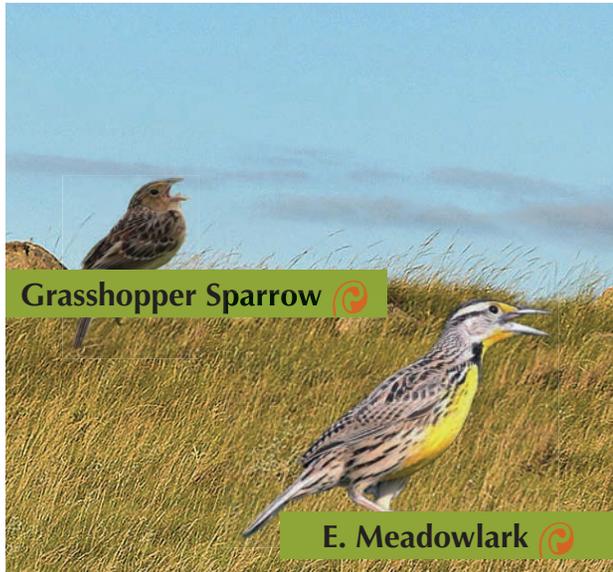
## Sunflower, Sorghum and “T” Perches Reduce Insects

**Live plant and “T” perches make it easier for birds to hunt insects.** Chickpeas with perches versus pesticide trials gained higher net returns. Plant perches also supported parasitoids which additionally reduced the pests.<sup>1</sup> Compared to monocultures, mixed crops supported more insect-eating bird species that foraged for pests, and did not damage crops.<sup>2</sup>

In feeding trials using parasitized and non-parasitized Armyworms, birds strongly preferred the larger non-parasitized insects, leaving the next generation of natural enemies to hatch.<sup>3</sup>

<sup>1</sup> Gopali et al. 2009.  
<sup>2</sup> Jones and Sieving 2006.  
<sup>3</sup> Jones et al. 2005a and 2005b.

# Birds Consuming Pest Insects and Weeds in Grasslands and Pastures



## More than Beautiful Singers, These Birds Reduce Grasshoppers

**Birds reduced grasshoppers by 25–55% in grasslands, preying selectively on different species and in different sites.**<sup>1,2,3</sup> Foraging behavior of the birds was altered by the effects of drought, other predators, parasites, pathogens, and grazing intensity, which changed grasshopper distributions and influenced which patches the birds foraged. There is an interesting interplay between external forces defining grasshopper patches, and the dynamics of the bird predators with their prey.

- 1 Joern 1986 & 1992.
- 2 Fowler et al. 1991.
- 3 Bock et al. 1992.

## Context Matters: When a “Pest” Bird is Beneficial in Pastures

**European Starlings ate 40–60% of grass grubs in pastures, especially when the pest abundance was in the medium to high range.** Irrigation management and rotational grazing encouraged the birds to feed in infested paddocks. This combined strategy was effective in controlling grass grubs by preventing the population density from increasing above a level that affected spring pasture production.<sup>1</sup>

While starlings can be a pest at certain times in certain crops, they can also be beneficial.

- 1 East and Pottinger 1975.

## Weed Seed Decreases in Pastures and Other Fields

**Birds took 32% of the invasive Musk Thistle seeds in a pasture before they dispersed in the wind and on the ground.** Animals and Weevils and other animals also destroyed the weed seeds.<sup>1</sup>

In other research, waterfowl reduced weeds in rice by 52%,<sup>2</sup> and also reduced weeds in cranberry and cotton fields. Weed seeds were found during many examinations of omnivorous bird stomachs. Weed seeds are an important food source when other foods are not available.<sup>3</sup>

- 1 Kelly and McCallum 1990.
- 2 van Groenigen et al. 2003;
- 3 Kirk et al. 1996.

# Birds Consuming Pest Birds



## American Kestrel Nest Boxes Yield Big Savings in Cherries

**Fruit-eating birds were significantly fewer in orchards with American Kestrel boxes.** While kestrel nestlings typically were only fed 2% birds, the raptors' presence discouraged pest birds in the orchard. For every dollar spent on nest boxes, \$84–\$357 of sweet cherries may be saved from pest birds. Reduction of damage across the state of Michigan was estimated to result in \$2.2 million to \$2.4 million over five years.<sup>1</sup> Mowing to expose rodents is thought to increase raptors' effectiveness.

<sup>1</sup> Shave et al. 2018.

## Falcons Keep Pest Birds Guessing

**Releasing wild falcons in New Zealand vineyards was estimated to decrease pest bird damage enough to result in savings of \$234/hectare for the Sauvignon Blanc variety of grapes and \$326/hectare for Pinot Noir.** Actual numbers of pest birds were reduced by 78–83%, and grape damage by 55-95%.<sup>1</sup>

Some viticulturalists hire a falconer, which can be expensive, but besides the presence of the raptors themselves frightening the birds, they reinforce other scare tactics used to reduce pest-bird pressure.

<sup>1</sup> Kross et al. 2012.

## Perches Reduce Pest Birds in Vineyards

**Aggressive Australian Magpies used perches and scared pest birds, reducing grape damage by >50%.<sup>1</sup>** Raptors such as hawks did not use these artificial perches possibly because there were already enough trees and fence posts available for perching. Raptors such as falcons that rely on sight prefer high perches which give them the greatest visibility. Providing perches on a farm often increases raptors' presence and activity.<sup>2</sup>

<sup>1</sup> Peisley et al. 2017.

<sup>2</sup> Kay et al. 1994

# Birds Consuming Pest Rodents



## Barn Owl Nest Boxes Are Cost-Effective

Over a three-year period, Barn Owls killed more than 30,000 rodents in one vineyard for a fraction of the cost of trapping or poisoning. The average cost of trapping was \$8.11 per pocket gopher versus \$0.34 per rodent taken by Barn Owls.<sup>1</sup>

Other research found Barn Owls are effective unless rodent populations are extremely high.<sup>2</sup> Owls prefer wooden boxes that are facing north, high off the ground and near grasslands.<sup>3</sup>

<sup>1</sup> Browning et al. 2016.

<sup>2</sup> Kross and Baldwin 2016.

<sup>3</sup> Wendt and Johnson 2017.

## Savings Garnered From Nest Boxes and Perches

An agency in charge of keeping levees structurally sound reported substantially less damage from ground squirrels and gophers in areas with Barn Owl nest boxes and raptor perches than in areas treated with rodenticides. They estimate a cost savings of \$7,500 a year for each mile of levee.<sup>1</sup>

In other studies, increased avian predation significantly lowered crop damage by 20%, and was able to keep crop damage to less than 5%, which could lead to financial savings of up to \$30/hectare/year.<sup>2</sup>

<sup>1</sup> Novak et al. 2017.

<sup>2</sup> Labuschagne et al 2016.

## Perches Are Cheaper than Rodenticides in Reducing Rodents

Using raptor perches during a vole outbreak cost about 50% of the price of rodenticides. The perches, placed 5 per hectare, were as effective as poisons in reducing voles below economic injury level. Without perches, raptors did not increase markedly, even when the vole population was reaching its peak.<sup>1</sup>

Other studies showed that raptor perches were associated with reduced rodent population growth and density but not crop damage because rodent densities were so low,<sup>2</sup> possibly due to human activity.<sup>3</sup>

<sup>1</sup> Machar et al. 2017; <sup>2</sup> Kay et al. 1994; <sup>3</sup> Askham 1990.

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