



BARN OWLS CAN DECREASE PESTICIDE USE

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YOUNG REVIEWERS:



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Rodents are a danger to farmers because they damage farm crops. For the last 100 years, chemical pesticides have been used to kill rodents, but these chemicals harm the ecosystem, humans, and all sorts of wildlife, including migratory birds. Barn owls may be a solution! These nocturnal birds of prey are common over most of the world and can act as biological pest-control agents. Barn owls nest near and in farm fields and specialize in hunting rodents—a pair of barn owls eliminates 2,000–6,000 rodents per year. A project using barn owls for rodent control began in Israel in 1983, with the placement of 14 nesting boxes. Today, there are about 5,000 nesting boxes throughout Israel, and the use of harmful pesticides has decreased by more than 50%. Several other countries have also joined, or plan to join, the project. This project is a unique method that promotes a healthier environment and can connect nations, farmers, researchers, and conservationists.

PESTICIDES

Chemical agent to poison and kill pests in agriculture.

SECONDARY POISONING

Predators accumulating poison in their body by consuming poisoned prey, so the poisoning effect grows and harms predators as well.

RAPTORS

Predatory birds, catch prey with their strong feet with sharp talons.

BARN OWL

Nocturnal raptor of the owl family that preys on rodents. These owls have excellent vision and hearing and sharp talons, all of which make them great hunters.

THE NEED FOR PESTICIDES

For 1,000's of years, the natural landscape of Israel has been shaped by—and along with—the development of agriculture [1], to the point that, in some places, it is impossible to tell a natural landscape from a human-made one. In the last few decades, Israel has gone through many upheavals, transitioning from a sparsely populated Mediterranean region to one of the most densely populated countries in the Western world. To sustain its population, Israel had to develop intensive, modern, efficient, and affordable agriculture. As often happens, this involved the disconnection of agriculture from the surrounding natural environment and caused significant damage to natural ecosystems. **Pesticides** were one cause of environmental damage. Use of pesticides was necessary because the land was full of crop-harming pests. Since the beginning of modern agriculture, humans have been fighting a continuous and exhausting battle against pests of all kinds, from insects to rodents. On tens of thousands of hectares in Israel, farmers grew crops such as wheat, alfalfa (a grass that is used for feeding livestock), cotton, and fruit. As the crops grew, so did the populations of harmful rodents, such as voles and the house mouse.

PESTICIDES ARE HARMFUL CHEMICALS

Rodent-killing pesticides, which were developed over the twentieth century, cause serious damage to the environment [2]. Pesticides harm many animals, even those that are not pests; they seep into the water, contaminating it with harmful chemicals and endangering the health of those using it. Some types of pesticides are absorbed by vegetables or fruits and endanger those who eat them, including humans. If cows eat hay that was sprayed with pesticides, the toxic substances can reach humans through the cows' milk.

Additionally, certain pesticides break down very slowly, and they can cause what is called **secondary poisoning**. When a predator eats an animal that was poisoned by a pesticide, the pesticide residues that have not broken down in the prey animal's body cause secondary poisoning of the predator. In many places, secondary poisonings have caused the destruction of entire populations of **raptors** (birds of prey) and other bird species. The damage to the nocturnal raptor population was particularly unfortunate because these raptors, including **barn owls**, are the natural enemies of rodents. Rodents make up 95% of the diet of barn owls. Some of the damage caused to the environment and the animals that live in pesticide-treated areas is irreparable.

BIOLOGICAL PEST CONTROL

Using living creatures to control populations of pests such as rodents and insects; may help decrease the use of harmful chemical pesticides.

PELLET

Undigested parts of a raptors prey (such as feathers, hairs, bones, teeth, and nails) that are ejected from the mouth after a few hours, as a large pellet.

NESTING SUCCESS

Measured in how many chicks fledged per year

CAN BARN OWLS HELP OTHER BIRDS AND FARMERS?

The main goal of the barn owl project that we have been leading for 40 years is to significantly decrease the use of pesticides and to reduce the harm these chemicals cause to humans, the environment, wildlife and migrating birds. The idea of using barn owls as an environmentally friendly means of **biological pest control** arose in the 1970's.

About a billion migratory birds pass through Israel each year—500 million in the fall and 500 million in the spring (Figure 1). It is possible to observe about 550 different species of birds in Israel—an extraordinary number for a country of its size. Israel may be famous for its historical and archaeological heritage, but its bird populations are no less outstanding and unique. It is important for us to protect these migrating bird species, many of which could be harmed by pesticide use. The use of barn owls to keep the rodent population in check has significantly reduced the use of toxic pesticides in agricultural areas in Israel. In addition to the obvious environmental benefits, the use of barn owls reduces the costs of farming, so farmers save money. Since barn owls do not build nests, the original scientists provided the owls with nesting boxes placed in agricultural fields. In doing so, they hoped to increase the population of barn owls in the wild, and specifically in areas where they could be of use to farmers.

ISRAEL'S BARN OWL PROJECT

The barn owl project started in the Hula Valley, in the north of Israel. In 1982, two other scientists and I proposed this method in response to the deaths of thousands of migratory birds due to poisoning by small rodents called voles. Then, the First Lebanon War broke out; the farmers and researchers were enlisted to fight; one of the leaders of the project fell in battle; barn owls were poisoned and died; and the attempt failed.

The next attempt was made in 1983 [3], when 14 nesting boxes were placed in the organic fields and orchards of Kibbutz Sde Eliyahu in the Beit She'an Valley. Later, about 50 more nesting boxes were added, and these fields became an outdoor laboratory for scientists. They studied the relationship between predator and prey; analyzed the barn owl's **pellets**; learned about how far the owls usually travel; discovered the connections between **nesting success** (how many chicks fledged per year) and the size of the rodent population in the fields; and more. These studies greatly deepened the knowledge about barn owls and improved the way they were studied.

The researchers learned that a pair of barn owls and their chicks feed on 2,000–6,000 rodents per year (Figure 2). They concluded

Figure 1

Twice a year, about a billion birds pass over Israel as they migrate—500 million in each migration season (spring and fall).



Figure 1

that barn owls are a good substitute for toxic pesticides, and their use also saves farmers money. In 2008, the initiative was declared a national project, and nesting boxes were installed in agricultural areas all over the country. From 730 nesting boxes in 2008, we reached over 5,000 boxes in 2020. Data on each box and the history of nesting successes were tracked using computer software, and we also helped farmers learn about the project by holding seminars and meetings, publishing summary booklets, and placing online cameras in the nesting boxes.

FROM A REGIONAL TO AN INTERNATIONAL PROJECT

What started out as a local achievement has become a success story on a regional and international scale. From studies conducted with **GPS transmitters**, it is clear that barn owls know no borders; their flight paths cross from Israel to Jordan and the Palestinian Authority, and back. In the last two decades, we have joined forces

GPS TRANSMITTER

Transmits data intercepted by space satellites, to indicate the location of the animal to which it was attached.

Figure 2

A barn owl brings a vole to her chicks in a nesting box. The box was created from an ammunition box donated by the military industry. In 1983, 14 nesting boxes were placed in Kibbutz Sde Eliyahu in Israel; today there are over 5,000 nesting boxes throughout the country (photo credit: Amir Ezer).



Figure 2

with our Palestinian and Jordanian neighbors, and the barn owl project functions even in days of political conflict (Figure 3). In 2010, a world renowned expert from Lausanne University, Switzerland, Prof. Alexandre Roulin joined the project [4].

Figure 3

A Jordanian farmer and an Israeli farmer have been collaborating in a regional barn owl project since 2002. The flags along the top of the photo represent the countries currently participating in the project: Israel, Jordan, The Palestinian Authority, Switzerland, Greece, Cyprus, and Morocco (photo credit: Hagai Aharon).



Figure 3

In 2015, the project was expanded to include Cyprus, Greece, in 2021 Morocco joined, —even the United Arab Emirates are planning to join soon. In Cyprus, the hunting of wild animals and migratory birds is very common, as is the use of pesticides; and even in Greece the situation is far from ideal. Hopefully, the barn owl project

will raise awareness and help to protect birds—and the rest of the environment—in these regions [5].

ATLAS FOR BIOLOGICAL PEST CONTROL RESEARCH

In 2020, we started using an innovative and ground-breaking system called *Atlas* to monitor birds' movement. The system was developed in Israel in a collaboration between researchers from Tel Aviv University (Prof. Sivan Toledo) and the Hebrew University in Jerusalem (Prof. Ran Nathan). The ATLAS System is being used to follow Barn Owls movement by Dr. Orr Spiegel and his PhD student Shlomo Cain. *Atlas* is a system of antennas that enables the tracking of a wide variety of individual animals (weighing more than 10 grams) in real time. A reading of a tracked animal's position is obtained every 4–8 s. *Atlas* can operate for up to 2 years, depending on the size of the battery, and the **transmitter** is significantly cheaper than alternatives like GPS. The *Atlas* system currently contains 19 base stations, covering a total of ~300 km² in Beit She'an and Harod Valley.

TRANSMITTER

Special transmitters developed and produced specially for the Atlas project, that cost about 10% of an average GPS transmitter

Each of 136 barn owls were fitted with a small ring attached to one of its legs and a transmitter attached to its back. The details transmitted by *Atlas* enable accurate tracking of barn owl movement and behavior in the field, and all the data are recorded. These accurate measurements help researchers to locate and characterize rodent-infested fields before the rodents do large-scale damage, which will strengthen the cooperation between participating countries and support the training of farmers in the region in carrying out similar activities in their territories.

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YOUNG REVIEWERS

MAOR, AGE: 13

I live in Rishon Lezion. I enjoy reading about various topics, especially in the social sciences and humanities. I subscribe to *Epoch* magazine, whose content ranges from geopolitics to science and technology. In my spare time I like to study and also write a lot (in the third grade I won the national writing competition for a poem I wrote, and to this day I still like to write poems). I am learning the international language Esperanto, and take an online course on game theory. I am very happy to be part of this venture!

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Yossi Leshem is the former CEO of the Society for the Protection of Nature in Israel, Professor Emeritus at the School of Zoology at Tel Aviv University, and the founder and director of the International Center for the Study of Bird Migration. He is very active in the fields of education and science, and he leads cooperative projects with



the Jordanians, the Palestinians and other countries. He has won many awards, including a lifetime achievement award for the protection of the environment; the German Schubert Foundation award for nature conservation; and a lifetime achievement award from the Israeli Association for Ecology and Environmental Sciences. He is also a father of five children and grandfather of eight grandchildren.

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