

# INVESTING IN WILDLIFE CONSERVATION



How protecting wildlife habitats and our natural diversity  
benefits human health and economic well-being



*All. Together. Now.*

# Executive Summary

Indiana's natural landscape changed dramatically as the United States expanded westward and settlers moved into the state. The blanket of dense hardwood forest covering Indiana — interspersed with wetlands and prairie — was cleared, wetlands were drained and streams channelized for the benefit of agriculture and other human commerce. Today 64% of Indiana's land area is farmland. The state continues to lose open spaces to suburban sprawl and other land development. Our forest resources have rebounded through natural regeneration and restoration efforts to occupy about one-fourth of their former area.

Our forest heritage also shaped our wildlife heritage, given that woodlands were the primary wildlife habitat in Indiana before settlement. The woodland bison, gray wolf, mountain lion, and black bear that once lived here are gone, but our forests still shelter an amazing variety of wildlife today. In fact, Indiana habitats have harbored nearly 800 species of vertebrate animals, including ones that today are endangered or are extinct locally.

While the scientific basis for wildlife conservation is sound, its economic value is less well-known or appreciated. For example, the presence of outdoor lands such as parks, wildlife refuges, and the habitats they contain provide wildlife watching, fishing, hunting, picnicking, camping and hiking opportunities which have a measureable economic impact in the form of visitor spending and the purchase of outdoor equipment. Wildlife conservation also provides benefits in the form of ecosystem services provided by forests or wetlands, for example, which help protect air and water quality, and by wildlife species such as birds and bats which consume and control insect pests or pollinate plants.

This report summarizes a number of the existing scientific studies, economic impact reports, and other information to provide a deeper look at why the needs of plants and

animals should receive full and serious consideration in state and local economic development or land use policy and planning decisions. To do so will recognize that Indiana's human population is heavily dependent on the well-being of the other species we share our state with.

Following are our recommendations for ensuring that wildlife conservation is considered a priority public policy for Indiana:

1. The state of Indiana should complete a robust pollinator protection plan that includes not only protection for honeybees but also for native bees and other pollinators.
2. The use of neonicotinoid insecticides should be discontinued, and other pesticides should be closely monitored for negative impacts on insect pollinators.
3. The state of Indiana should increase its investment in wildlife habitat conservation and endangered species protection, by increasing funding for implementation of the State Wildlife Action Plan, and increasing funding for successful land, water and wildlife conservation programs including the President Benjamin Harrison Conservation Trust (formerly the Indiana Heritage Trust), Healthy Rivers Indiana, Clean Water Indiana, and the Wildlife Diversity program.
4. State and local government and businesses should undertake wildlife habitat restoration projects on their property.
5. Public and private land managers should protect and restore mature forests, wetlands, prairies, grasslands, stream corridors and other habitats that are home to pollinators and pest-eating birds and bats.

## Credits and Acknowledgements

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unless otherwise noted.

### Cover photos (clockwise)

Bumble bee, Great blue heron,  
Tiger swallowtail

### Page 10 photos

Eastern bluebird, Whooping crane Eastern  
box turtle (credit: National Park Service)

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embracing practices and policies that  
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## PART 1: INTRODUCTION

### Introduction: Landscape changes have altered our ecological support structure

***“To keep every cog and wheel is the first precaution of intelligent tinkering.” Aldo Leopold, A Sand County Almanac: With Other Essays on Conservation from Round River***

Indiana’s natural landscape changed dramatically as the United States expanded westward and settlers moved into the state. The blanket of dense hardwood forest covering Indiana — interspersed with wetlands and prairie — was cleared, wetlands were drained and streams channelized for the benefit of agriculture and other human commerce. Today 64% of Indiana’s land area is farmland.<sup>1</sup> The state continues to lose open spaces to suburban sprawl and other land development<sup>2,3</sup> and has only remnants of its former forest glory. Commercial logging and land clearing for farms reduced our forest resource from 20 million acres to roughly 1.5 million acres at the beginning of the 20<sup>th</sup> century<sup>4</sup>, but this resource has rebounded through natural regeneration and restoration efforts to encompass nearly 5 million acres of forestland today.<sup>5</sup> Perhaps 2,000 acres of old growth forest remain.<sup>6</sup>



Our forest heritage also shaped our wildlife heritage, given that woodlands were the primary wildlife habitat in Indiana before European settlement. The woodland bison, gray wolf, mountain lion, and black bear that once lived here are gone, but our forests still shelter an amazing variety of wildlife today. In fact, Indiana’s habitats have harbored nearly 800 species of vertebrate animals<sup>7</sup>, including endangered mammals such as the Indiana bat and swamp rabbit, birds such as the interior least tern and cerulean warbler, and amphibians and reptiles including the hellbender and northern copper-bellied watersnake.<sup>8</sup> Along with forest habitats, the Indiana landscape contains wetlands, caves, thousands

of miles of streams and rivers, natural lakes, prairie, and the dunes and savannas near Lake Michigan.<sup>9</sup>

Besides the Indiana bat and twelve other bat species, other mammals found in our woods include whitetail deer, red and gray fox, and bobcat. Rare amphibians and reptiles include the eastern box turtle and timber rattlesnake.<sup>10</sup> Since European settlement reached Indiana, 26 native vertebrates have become extinct or extirpated. Two of these lost species native to Indiana are also extinct globally — the passenger pigeon and Carolina parakeet.<sup>11</sup>



The wildlife habitats of Indiana are in some instances thriving, and in other cases under threat from pollution, ill-advised land development and urban sprawl, invasive species, and climate change.<sup>12</sup> Over half of Indiana’s lakes contain contaminated fish that are unfit to eat<sup>13</sup>, and sediment and excess nutrients from agricultural and urban areas reduce our waters’ habitat quality for fish, mussels, and animals that depend on aquatic prey including river otters. A fourfold increase in logging on Indiana State Forests that began in 2005<sup>14</sup>, along with clearing of private forests for suburban development, threatens forest habitats on public and private lands. Rules that require mitigation for impacts to wetlands are too often ineffective in ensuring that wetlands lost to development are replaced.<sup>15</sup> Consistently lucrative prices for commodity crops have encouraged some farmers to resume cultivation of marginal farmland which had been restored as wildlife habitat through Farm Bill programs.<sup>6</sup>

While the scientific basis for wildlife conservation is sound, its economic value is less well-known or appreciated. For example, the presence of outdoor lands such as parks, wildlife refuges, and the habitats they contain provide wildlife watching, fishing, hunting, picnicking, camping and hiking opportunities which have a measurable economic impact in the form of visitor spending and the purchase of outdoor equipment. Hoosiers and our visitors spent nearly \$1.8 billion in 2011 in pursuit of wildlife-associated recreation, according to the U.S. Fish and Wildlife Service.<sup>17</sup> Outdoor recreation in all its forms contributes nearly \$16

billion a year to Indiana’s economy.<sup>18</sup> Wildlife conservation also provides benefits in the form of ecosystem services provided by forests or wetlands, for example, which help protect air and water quality, and by wildlife species such as birds and bats which consume and control insect pests or pollinate plants.<sup>19</sup>



However, many of Indiana’s decision makers are not aware of the economic benefits that accrue from conserving wildlife habitats and other outdoor lands. Thus when economic activities come into conflict with wildlife conservation interests, the needs of wildlife are often considered secondary or overlooked completely.

This report summarizes a number of the existing scientific studies, economic impact reports, and other information to provide a deeper look at why the needs of plants and animals should receive full and serious consideration in state and local economic development or land use policy and planning decisions. To do so will recognize that Indiana’s human population is heavily dependent on the well-being of the other species we share our state with.

## PART II

### Ecosystem services keep the planet functioning

The earth’s natural systems make our planet livable—providing our air, water, shelter and food. Microbes, plants, fungi and algae are part of this life support system, and the animal kingdom makes up another part – fish, wildlife, insects and other invertebrates.<sup>20</sup> The multitude of naturally-occurring activities and functions provided by plants, animals and natural communities are known as “ecosystem services”<sup>21</sup>. Some estimates place the value of these services to humans at over \$50 trillion worldwide.<sup>22</sup>

Among the better known services animals provide are pest control, pollination, seed dispersal and waste treatment. Invertebrates such as butterflies and bees are invaluable

pollinators, assuring the survival of trees, herbaceous plants, and food crops. Native insects’ contribution to two specific ecological services – pollination and control of plant-eating insects – is worth over \$7.5 billion annually in the U.S.<sup>23</sup> In addition to being pollinators, bats and birds control insect pests and disperse seeds, contributing to the health of forests and agricultural crops as well as the genetic diversity of trees and other plants.



### POLLINATION

Almost 90% of all plant species, and about three-quarters of food crops grown globally, rely on animals for pollination.<sup>24</sup> Among the high value pollinated crops grown in Indiana are tomatoes, cantaloupes, watermelons, blueberries and green beans.<sup>25</sup> See Table 1.

**Table 1. Indiana crops dependent on animal pollination**<sup>26,27,28</sup>

Crop	Pollinators	Crop value
Watermelon	Honeybees, bumble bees	\$29.2 million (2017)
Cantaloupe	Honeybees, bumble bees	\$8.2 million (2017)
Apples	Honeybees, bumble bees	\$7.8 million (2015)
Cucumbers	Honeybees, bumble bees	\$3.7 million (2014)
Blueberries	Honeybees, bumble bees	\$3 million (2015)
Tomatoes	Bumble bees, honeybees	\$29.7 million (2017)

*Note: the listed crops are ones for which animal pollination is either essential or strongly needed.<sup>29</sup>*

Pollination takes place when pollen from the male part of a flower is moved to the female part of the same flower or another flower and fertilizes it. Once this occurs the plant can produce fruits and seeds.<sup>30</sup> While some plants are pollinated by the wind, approximately 80% of all flowering plant species require animals to transport their pollen.<sup>31</sup>

Pollen may be collected incidentally while a bird, butterfly or other species is visiting a plant to feed, collect nest materials, or find a mate.<sup>32</sup> Pollen will stick to the animal’s body and then be deposited when they visit another flower. Honey bees and native bees are the most effective pollinators because they intentionally collect and transport pollen to feed their larvae.<sup>33</sup>

Pollinators contribute over \$24 billion to the U.S. economy each year, with \$15 billion in benefits attributed to honeybees and \$9 billion credited to native insect pollinators.<sup>34</sup> A study on the economic dependence of U.S. industry on animal pollination services estimated the value of these services at \$24.5 billion to \$44.9 billion.<sup>35</sup>

As described in the following sections, many of North America's native pollinator species are declining in population, and several are listed as federally or state endangered.<sup>36</sup>

## Bees

Honeybees (*Apis mellifera*) may be the most well-known pollinators. These bees are not native to the U.S. but are well-established here, both in wild populations and as managed bees for the production of honey and as commercial pollinators.

There are 4,000 native bee species in the U.S.<sup>37</sup> Indiana is home to 430 species of bees.<sup>38</sup> For wild as well as cultivated plants, native bees are critically-important pollinators. In fact, native bee species are more efficient pollinators than honeybees for many types of crops, including apples, watermelons, and tomatoes.<sup>39</sup> For example, compared to the 15,000 to 20,000 honeybees needed to pollinate an acre of apple trees, just 250 native blue orchard bees can accomplish the same task.<sup>40</sup>

There are 50 species of native U.S. bumble bees.<sup>41</sup> Ten of these have been found in Indiana.<sup>42</sup> Some are sought after for tomato pollination, which the bees fertilize by vibrating their body to shake the pollen onto the plant – known as “buzz pollination”.<sup>43</sup> Bumble bees also pollinate berries, peppers, tomatoes and eggplant.<sup>44</sup> Another native bee, the miner bee, pollinates willow, maple and apple trees.<sup>45</sup>



According to the U.S. Department of Agriculture, managed bees generated \$655.6 million in gross revenues in 2012 for the commercial beekeepers who travel around the country making their bees available to specific crops in need of pollination.<sup>46</sup> Almonds are by far the largest

source of managed bee revenue, followed by sunflowers, canola, grapes and apples.<sup>47</sup> Honeybees support the fruiting and seed production of 90 to 130 types of food crops, representing about one-third of the U.S. diet.<sup>48</sup>

## Butterflies and moths

The plight of the Monarch butterfly has helped call attention to the importance of butterflies as pollinators. In 2014 Monarch populations were at their lowest number ever recorded.<sup>49</sup>



149 of the 700 native U.S. butterfly and skipper species are found in Indiana, among them swallowtails, fritillaries, duskywings and admirals commonly seen on many of our wild and garden plants.<sup>50</sup> Butterflies generally prefer colorful flowering plants such as coneflowers and other members of the daisy family.<sup>51</sup> Butterflies pollinate cultivated plant varieties such as dahlias, marigolds, zinnias, and peonies.<sup>52</sup> These are valued lawn and garden plants. The floriculture sector (garden flowers, potted plants, cut flowers, etc.) of the lawn and gardening industry in Indiana generated \$64 million in sales in 2012.<sup>53</sup>

Monarch butterflies almost wholly depend on the milkweed plant for their survival. Monarch caterpillars eat only milkweed, and the females will lay eggs only on or near milkweeds.<sup>54</sup>

The problems experienced by honeybees, native bees like bumble bees, and butterflies are helping call attention to the essential need to protect native wild pollinators and their habitats. Scientists, farmers and bee producers are concerned about declines in honeybee populations. There are a number of known and suspected culprits in honeybee decline, including parasitic mites, disease, habitat loss, and colony collapse disorder (CCD).<sup>55</sup> Pesticides, including the widespread use of a lethal class of insecticides known as neonicotinoids also are a direct threat to honeybees as well as many other pollinators.<sup>56</sup> New research in Indiana concludes that “Nearly every foraging honey bee in the state of Indiana will encounter neonicotinoids during corn planting season..”, according

to the research team which includes faculty from Purdue University.<sup>57</sup> These insecticides are highly toxic to honeybees. Neonicotinoids are used to coat corn and soybean seeds to protect them from pests, yet the same study finds little improvement in crop yield from their use.<sup>58</sup>

Like honeybees, native bee populations are in trouble. In March 2017 the U.S. Fish and Wildlife Service listed the Rusty Patched bumble bee, native to Indiana, as an endangered species. The population of this bumble bee — once spread across 28 states and 2 Canadian provinces — has declined by 87% in the last 20 years, and is now found only in a few places in 13 states and one province.<sup>59</sup> A combination of habitat loss, pesticides, disease and climate change is the likely cause of the bee's decline.<sup>60</sup>

In 2014, the U.S. government launched a strategy to promote the health of honeybees and other pollinators.<sup>61</sup> The strategy “calls for the establishment of a Pollinator Health Task Force co-chaired by the USDA and EPA. The task force is charged with developing a National Pollinator Strategy to coordinate research and create an action plan, which will focus efforts on understanding, preventing and recovering from pollinator losses. The strategy also includes a public education plan and recommendations for developing public-private partnerships. Underscored throughout the memorandum is the need to increase and improve pollinator habitat.”<sup>62</sup>

Indiana is developing a Pollinator Protection Plan under the direction of the Office of the Indiana State Chemist. Indiana's plan will “... encompass activities and policies that could be helpful in protecting pollinators from stressors that may be detrimental to the health of both managed and native pollinators in Indiana.”<sup>63</sup> The latest draft of the plan was produced in March 2017.<sup>64</sup>

## Birds



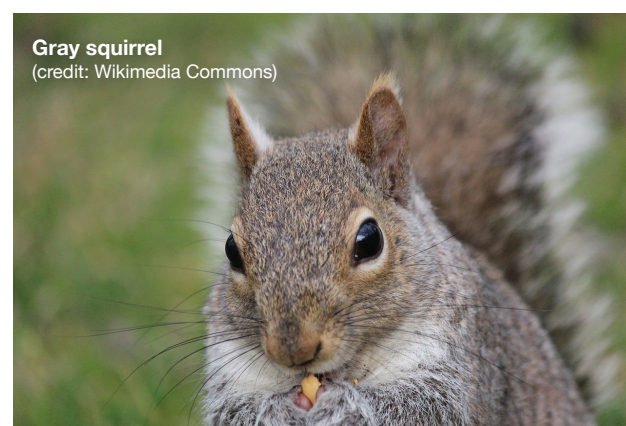
Many species of birds eat nectar and thus act as pollinators as pollen clings to their body and is then

passed on to other plants. The Ruby-throated hummingbird, the only hummingbird species native to the eastern U.S., is a robust pollinator.<sup>65</sup> Other birds such as finches, chickadees and the cardinal commonly come into contact with plant pollen while gathering seeds, as do insect-eating birds which may capture their prey while the insects are feeding at flowering plants.<sup>66</sup>

## PLANT DIVERSITY – SEED DISPERSAL

Fruit and seed-eating birds are among several species of wildlife which help disperse plant seeds far from the parent plant, contributing to the genetic diversity of the affected plant species.<sup>67</sup> Because birds travel long distances, they are particularly effective at helping distribute the genetic material in seeds very widely.<sup>68</sup> About one-third of bird species disperse seeds, either by eating fruit or scatter-hoarding of nuts and conifer seeds.<sup>69</sup>

Seed-eating mammals like squirrels and chipmunks — common in Indiana's forests, parks and many backyards — are also active seed dispersers. Squirrels will carry acorns and other mast (tree nuts) some distance from the parent tree, caching it in the ground for later consumption but not recovering every nut.<sup>70</sup>



**Gray squirrel**  
(credit: Wikimedia Commons)

Animals that eat plant fruits, such as raccoons and opossum, disperse the seeds in their feces.<sup>71</sup> Fur-bearing mammals move seeds which attach passively to their fur and drop off as the animal moves.<sup>72</sup>

## PEST CONTROL

### Birds

Studies of birds' insect pest-eating habits began over a century ago. As far back as the late 1800's biologists Edward Forbush and Charles Fernald<sup>73</sup> noted 38 bird species which feed upon the gypsy moth — a destructive non-native forest insect pest present in Indiana and much

of the U.S.<sup>74</sup> — in its immature or adult forms, including downy and hairy woodpecker, eastern phoebe, blue jay, scarlet tanager and red-eyed vireo. These are all birds common to Indiana.<sup>75</sup> Yellow and black-billed cuckoos, catbirds, blue jays, robin, and red-eyed vireo were among the species singled out as particularly effective gypsy moth predators<sup>76</sup>

In a comment perhaps overstated, but not uncommon to the era, the authors said, “Land birds fulfill [sic] their part in many ways in preserving the balance of nature, but chiefly by doing much toward holding in check the increase of the insect world, which if unrestricted, would swarm over and devastate the earth.”<sup>77</sup>



Hairy woodpecker

Woodpeckers depend on insects for a substantial portion of their diet.<sup>78</sup> Among the insects they consume are a number of forest and agricultural pests. For example, in Michigan three species of woodpecker – downy, hairy and red-bellied woodpecker – were the most noticeable predators of immature Emerald Ash borers, eating 16% of the EAB larvae and pupae at the studied sites.<sup>79</sup> In a study of Ohio hardwood forests, bark-foraging birds preyed on roughly 45% of ash borers in ash trees with thinning canopies (indicating EAB infestation).<sup>80</sup> The birds, including downy, hairy and red-bellied woodpeckers and white-breasted nuthatches, “....forage more heavily on ash trees than non-ash trees, and that they forage preferentially on ash trees that exhibit canopy decline symptoms relative to those with healthy canopies.”<sup>81</sup> This invasive ash borer is causing serious damage to native ash trees throughout the U.S. including in Indiana. Over 4 million live ash trees that were five inches or more in diameter were killed in Indiana between 2009 and 2013 by the emerald ash borer.<sup>82</sup>

Many studies have considered birds’ role in controlling agricultural insect pests. “Few insectivorous bird species are entirely beneficial or entirely harmful to agriculture, but the evidence we (and others before us, e.g., McFarlane, 1976) have reviewed suggests that the overall balance is overwhelmingly positive. Strong experimental evidence

indicates that the predatory activities of birds can suppress insect populations, at least at medium to low infestation levels. This “ecological service” should be factored where possible into integrated pest control plans, and the farm landscape should be managed with birds in mind.”<sup>83</sup> Cornborers, grasshoppers and defoliating insects are among the insect pests sought out by bird predators.<sup>84</sup> Studies have shown that birds not only reduce plant-eating insects, but also that plants respond with higher growth rates or crop yields.<sup>85</sup>

Insect-eating birds contribute to the growth and health of white oak trees, found widely in Indiana forests, that benefit wildlife by producing mast (acorns). White oak is also a highly valued commercial species, ranking as the third highest species by production output in Indiana.<sup>86</sup> By consuming leaf-chewing insects, insectivorous birds benefit oak forests, according to a Missouri study whose authors noted, “Our study demonstrates that the presence of birds enhances the growth of juvenile white oak trees via bird consumption of leaf-damaging insects.”<sup>87</sup>

### *Bats and other mammals*

The 13 bat species that live in Indiana are insect-eating bats which consume moths, beetles, flies, and mosquitoes.<sup>88</sup> Bats may consume up to 50% of their body mass each day, and a female little brown bat may consume 100% of her body mass while nursing her young.<sup>89</sup>



Indiana Bat  
(credit: U.S. FWS)

The pest-control services that bats provide to American agriculture are valued from a low of \$3.7 billion to a high of \$53 billion a year.<sup>90</sup> This estimate includes the value of avoided pesticide use. It does not include the value of forest insect pest control provided by bats since there are few economic studies on this topic, although bats are recognized as providing suppression of forest insects.<sup>91</sup> The authors of this study note, “Even if our estimates are halved or quartered, they clearly show how bats have enormous potential to influence the economics of agriculture and

forestry.”<sup>92</sup> The big brown bat, native to Indiana, consumes a variety of insects. A single big brown bat colony of 150 bats was estimated to consume 1.3 million insects each year.<sup>93</sup> Included among these bats’ diet were 600,000 spotted cucumber beetles and 158,000 leafhoppers. The cucumber beetle’s larva – known as the corn rootworm – is a major pest of corn.<sup>94</sup> Bats can consume enough adult corn earworms to affect larval numbers, thereby reducing crop damage by these insect pests.<sup>95</sup>

Termites are found in the diet of two bats found in Indiana—the big brown bat and the silver-haired bat.<sup>96</sup>

Leafhoppers, which feed on major crops such as potatoes, apples, and grapes, are preyed on by evening bats, big brown bats, Indiana bats, and the eastern pipistrelle.<sup>97</sup>

Indiana bats feed on the Hessian fly, a major pest of wheat crops as well as barley and rye.<sup>98</sup> Wheat is the fourth largest crop in Indiana by value.<sup>99</sup>

At least three bats of Indiana feed on mosquitoes, although these insects are not generally a large part of bat diets because they are too small for bats to feed on effectively. However, when swarming, mosquitoes make a more attractive target for feeding bats.<sup>100</sup>



Small mammals are predators of forest insects, including the gypsy moth. The white-footed mouse (*Peromyscus leucopus*) native to Indiana, feeds on gypsy moth larvae and pupae found in leaf litter.<sup>101</sup> The authors of one gypsy moth study concluded “...that predation by small mammals is responsible for the regulation of low-density gypsy moth populations.”<sup>102</sup>

### *Wildlife benefits to medicine, science and technology*

Just as many plants produce compounds that are used in modern medical treatments, animals also make contributions to medicine and science.

Exendin-4, a hormone found in Gila monster saliva is used in its synthetic form as a treatment for type 2 diabetes.<sup>103</sup> Gila monsters are native to the American southwest.<sup>104</sup> The vampire bat, one of the earliest icons of horror movies, produces an anticoagulant compound in its saliva that has been studied as a treatment for stroke, but to date salivary plasminogen activator (DSPA) has not been produced commercially.<sup>105,106</sup>

Bats navigate successfully at night by using echolocation – a form of biosonar that uses sound and its echo to locate static objects as well as bats’ typical prey, flying insects.<sup>107</sup> Studies of echolocation and bat flight have stimulated new innovations in medical ultrasound equipment, wireless communications, sonar, and biomimetics – the science of designing new technologies based on natural forms and systems.<sup>108,109</sup>

### *Quantifying ecosystem services at the habitat level*

The first task of fish and wildlife conservation is to protect habitat. In Indiana the principal natural habitats are forests, wetlands, prairies, streams and lakes. The economic value of wildlife habitat conservation was considered in “The value of ecosystem services provided by the U.S. National Wildlife Refuge System in the contiguous U.S.”<sup>110</sup>

In describing their study, the authors noted, “A large proportion of ecological economics studies are designed to estimate the value, in monetary terms, of ecosystem goods and services that are not subject to market transactions and are not, therefore, accounted for in standard measures of national income such as GDP. Our paper represents such a study as applied to the Refuge System.”<sup>111</sup>

The authors assigned value to the following ecosystem services provided by the ecosystems present in the assessed wildlife refuges: climate and atmospheric gas regulation; freshwater regulation and supply; waste assimilation and nutrient regulation; habitat provision; and, disturbance prevention. The report estimated that the National Wildlife Refuge system in the contiguous U.S. provides ecosystem services worth \$26.9 billion a year.<sup>112</sup>

One outcome of the study was to assign a per acre value to the ecosystem services provided by the specific habitat types on the wildlife refuges. Extrapolating these per acre values to habitats in Indiana’s national wildlife refuges, the total value of ecosystem services supplied by Indiana’s national wildlife refuges is estimated in Table 2. Most types of outdoor lands protect wildlife habitats, but national wildlife refuges are an example of public lands which emphasize habitat protection and restoration as their principal mission.

**Table 2. Indiana’s national wildlife refuges and their estimated habitat values**

Habitat type/value per acre	Muscatatuck National Wildlife Refuge <sup>113</sup>		Patoka River National Wildlife Refuge <sup>114</sup>		Big Oaks National Wildlife Refuge <sup>115</sup>	
	Acres	Value	Acres	Value	Acres	Value
Wetlands: \$8,800/acre	5,461	\$48,056,800	7,881	\$69,352,800	5,330	\$46,904,000
Forests: \$850/acre	1,210	\$1,028,500	919	\$781,150	35,447	\$30,129,950
Grasslands: \$51.40/acre	80	\$4,112	919	\$47,237	8,958	\$460,441
Shrubland: \$550/acre	700	\$385,000	75	\$41,250	1,537	\$845,350



## PART III

### Tourism, outdoor recreation and wildlife-associated recreation

Americans spend a lot of money to enjoy wildlife. Some spend to hunt animals, some spend to fish, and many more spend money to watch wildlife. And when people are willing to spend money on an activity, opportunities are created for the businesses that cater to the people recreating outdoors and enjoying wildlife.

Every five years, the U.S. Fish and Wildlife Service conducts a survey of the people who fish, hunt and watch wildlife.<sup>116</sup> The survey reveals that Americans spent \$157 billion--almost 1% of the U.S. Gross Domestic Product--in 2016 on these pursuits; what the Fish and Wildlife Service terms “wildlife-associated recreation”.<sup>117</sup>

The Fish and Wildlife Service surveys report wildlife-associated recreation by state in addition to the national findings. For Indiana, the surveys<sup>118</sup> reveal that:

- Over 2 million people participated in wildlife-associated recreation in Indiana: 801,000 in fishing; 392,000 in hunting, and 1,719,000 watched wildlife.<sup>119</sup>
- Hoosiers and visitors spent \$1.7 billion on wildlife related recreation in Indiana.<sup>120</sup> In 2011, Hoosiers spent \$1 billion, in Indiana and elsewhere, to watch birds, deer and other wildlife. Hoosier anglers spent \$674 million trying to land a largemouth bass, catfish, bluegill, steelhead or other sportfish. Hunters spent almost \$241 million.<sup>121</sup>

Nationally, the number of anglers and wildlife watchers increased from 2006 to 2016. The number of people hunting declined from the 2006 survey to the 2016 survey.<sup>122</sup>

The economic benefits of bird watching in particular were evaluated in an addendum to the Fish and Wildlife Service's national survey. This report found that bird watchers' spending on travel and equipment generated over 660,000 jobs and \$13 billion in local, state and federal tax revenues.<sup>123</sup>

More information about the economic value of wildlife conservation is provided in the outdoor recreation impact reports prepared by the Outdoor Industry Association (OIA).<sup>124</sup> In its third report on this topic, the OIA —the trade association for outdoor gear manufacturers and retailers — calculated the total economic impact of this industry — looking at consumer spending, jobs, and tax revenue generated.<sup>125</sup> The findings of these reports shed more light on outdoor recreation that includes wildlife-related activities.

The state level data in OIA's 2017 Outdoor Recreation Economy Report found that outdoor recreation in Indiana stimulated \$15.7 billion in consumer spending and 143,000 jobs.<sup>126</sup> The report also credited outdoor recreation with generating \$1.1 billion in state and local tax revenues.<sup>127</sup> Nationally, outdoor recreation is fourth in consumer spending behind hospital care, outpatient health care, and financial services- insurance.<sup>128</sup>

Wildlife-related visits to National Forests generated \$1.4 billion in visitor spending in local economies along with 20,000 jobs between 2008 and 2012, according to a study by the U.S. Forest Service.<sup>129</sup>

In Indiana, Great Lakes sport fishing is estimated to produce nearly \$19 million a year in retail sales and over 200 jobs.<sup>130</sup>

Aquatic habitat and species conservation nationwide is estimated to produce \$3.6 billion in annual economic benefits which result in over 68,000 jobs.<sup>131</sup> The activities that produce these benefits include wetland and stream habitat restoration and enhancement including reopening rivers and streams to fish passage, invasive species control, and providing recreational fishing opportunities.<sup>132</sup>



## PART IV

### Conclusion and recommendations

Conserving wildlife and the habitats that animals depend on benefits both humans and the American economy in many ways. These economic benefits — worth billions of dollars — include the ecosystem services that make our planet livable and that provide the food we eat and the beverages we drink. Wildlife conservation also contributes greatly to Hoosiers' enjoyment of the outdoors, and in doing so provides economic value in the form of spending on tourism and outdoor recreation and the jobs and business opportunities this spending generates.

*“When we try to pick out anything by itself, we find it hitched to everything else in the Universe.” John Muir*

However, we should not just think about our native wildlife in terms of their direct economic benefit to humans. For our birds, mammals, insects and other living creatures also have an inherent value as part of the earth's biological web of life, as well as providing spiritual and aesthetic value that cannot be measured. People treasure the joys of wildlife around them — the hoot of a barred owl, the musical chorus of crickets and frogs at night, the howl of a coyote, the song of a wood thrush, or the darting flight of a monarch — without any consideration of whether there is economic value in such experiences.

Given the foregoing, it is critically important — for our survival and economic well-being — that Indiana invest in wildlife conservation and factor in the importance of wildlife habitat protection and species conservation in every aspect of our land use and economic development planning.

Assigning wildlife conservation its due priority is all the more important given that so many of our native animals are endangered or declining in numbers. According to the U.S. Fish and Wildlife Service, at least 3 bat, 5 bird, 24 butterfly, skipper and moth, one beetle and one fly species in the United States that are considered federally endangered are pollinators.<sup>133</sup> The Indiana Department of Natural Resources has identified 152 fish and wildlife species as “species of greatest conservation need” which includes the animals listed as state or federally endangered.<sup>134</sup> Twelve of Indiana's thirteen native bat species are on this list, as well as 48 bird species.<sup>135</sup> One Indiana bee species, the Rusty Patched bumble bee (listed in 2017 as federally-endangered), and 10 Indiana butterfly and moth species, including the critically imperiled Karner Blue and Mitchell's Satyr are included on the Xerces Society for Invertebrate Conservation Red List of imperiled insects.<sup>136</sup>

Indiana law provides no protection for the honeybees and wild bees, butterflies and other beneficial insects that are valuable as food crop pollinators. As noted earlier, many bee populations are declining due to habitat loss, disease and parasites, and insecticide use. Habitat destruction and insecticides are also responsible for the dramatic decline in the monarch butterfly population. White-nose syndrome (WNS), a fungal disease that is frequently fatal to bats, is causing dramatic declines in American bats including seven of the species found in Indiana.<sup>137</sup> One study estimated that the loss of one million bats from white-nose syndrome means that as many as 1,320 tons of insects are no longer being consumed by bats in areas where the resident bats are infected by WNS.<sup>138</sup>

Following are our recommendations for ensuring that wildlife conservation is considered a priority public policy for Indiana:

1. The state of Indiana should complete a robust pollinator protection plan that includes not only protection for honeybees but also for native bees and other pollinators.
2. The use of neonicotinoid insecticides should be discontinued, and other pesticides should be closely monitored for negative impacts on insect pollinators.
3. The state of Indiana should increase its investment in wildlife habitat conservation and endangered species protection, by increasing funding for implementation of the State Wildlife Action Plan, and increasing funding for successful land, water and wildlife conservation programs including the President Benjamin Harrison Conservation Trust (formerly the Indiana Heritage Trust), Healthy Rivers Indiana, Clean Water Indiana, and the Wildlife Diversity program.
4. State and local government and businesses should undertake wildlife habitat restoration projects on their property.
5. Public and private land managers should protect and restore mature forests, wetlands, prairies, grasslands, stream corridors and other habitats that are home to pollinators and pest-eating birds and bats.



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