

The NATURAL HERITAGE *of* INDIANA

250 years ago, the landscape that would become Indiana was part of a vast wilderness, its present day boundaries unmapped, and unrecognized.



Highlands of Indiana

Stretching to the horizon and beyond, primeval forests towered nearly 200 feet tall.

From the big rivers in the south, northwards to the shore of one of the largest lakes on earth, Indiana held an incredible diversity of terrain, and wildlife.

But over the course of little more than a century, Indiana was altered beyond recognition, from what it once was.

On the shores of Lake Michigan, industry sits today where once 200 foot sand dunes stood.

Millions of acres of forests, prairies, and wetlands have been converted into agriculture.

And seemingly everywhere as our population grows, and our towns sprawl, the remnants of a distant past are fragmented yet further.



Subdivision

Surprisingly, however, a diverse natural world has survived in Indiana. It even flourishes.

This series is a celebration of the natural wonders of Indiana. It remembers a lost wilderness, explores the present day, and looks forward to a future when we might welcome back more of what has been lost.

This is *The Natural Heritage of Indiana*.



The Natural Heritage of Indiana is made possible through the generous support of the Nina Mason Pulliam Charitable Trust, through a grant to the Friends of the Indiana State Archives. Helping people in need...protecting animals and nature...enriching community life.

The Efroymsen Family Fund, a Central Indiana Community Foundation Fund. The Efroymsen Family Fund: supporting the community for generations.

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And the Indiana Native Plant and Wildflower Society: Promoting appreciation and conservation of Indiana's native plants.

EPISODE ONE: THE INDIANA THAT WAS

4 billion years ago, the earth was in the midst of great change. The superheated landscape, until now too hot and molten for a permanent surface to form, had begun to cool.

As a result, the gasses and steam that were vented during volcanic eruptions also began to cool. They condensed into something that would have a tremendous impact upon the geology and landscape of Indiana.

Water.

Over millions of years, the low lying basins filled, as the first small seas took shape.

The earth's crust by now had cooled to the point where permanent land could form.

But as the seas grew in size, the newly formed continents remained barren, with Great Plains of lifeless rock, still dotted with volcanic eruptions.



It was in the oceans that life would first evolve.

For over 3 billion years, waves crashed upon rocky shores, empty of life.

But beneath the surface, life flourished.

For 2 billion years, single celled bacteria and algae were the dominant life in earth's oceans.

1 billion years ago, multi-celled organisms began to appear, and they grew increasingly complex

By 500 millions years ago, marine animals had evolved shells, and complex communities began to grow on the sea floor.



As continents drifted across the earth's mantle, Indiana by this time was at the bottom of a shallow tropical sea, just south of the equator.

An incredible diversity of corals and crinoids existed then, forming reefs in seas that would have often been shallow enough to wade across.

Ancient Indiana Coral Reef: Falls of the Ohio Interpretive Film

The crinoids, marine animals related to starfish, had a central stalk topped by tentacles that searched for food.

They left many fossilized remains that today are among the most significant of their type on earth.

For millions of years, these shallow seas covered all or portions of Indiana. As the reef creatures died, their shells sank to the bottom, building up layer upon layer.

These layers were ultimately transformed into rock, which today forms the limestone deposits for which Indiana is renowned.

Along with the coral and other reef creatures, crab-like trilobites inhabited the state as well.

It was animals such as these that were among the first to leave the water, and venture into the world above.

The oceans by this time were crowded with species, and predators were common. But beyond the water's edge, there was nothing, and so some creatures crawled up out of the surf, seeking safety, as well as opportunities.



Horseshoe Crabs

These marine animals were unable to live out of water for long.

Seeking to scavenge a meal, the first may have been attracted by debris washed up onto the beaches. These food sources had previously been unavailable to those species unable to leave the water

Others may have come ashore to mate, safe from the predators that might eat them, or their eggs.

Over millions of years, the numbers of species that could use the area in and just beyond the surf likely increased.

But without plants that could grow on dry land, they were only visitors.



And so away from the water's edge, the landscape remained barren.

Over several hundred million years, the seas periodically covered Indiana, with water draining away, and then returning. But ultimately, the ocean waters receded for good, and Indiana became a dry wasteland of rock.

400 million years ago, something new appeared on land – something that would transform Indiana, and the world:

Plants.

At first confined to where water kept them from drying out, land plants evolved thick skins to conserve moisture, and stiff structures to support them as they grew upwards, towards the sun.



Tropical forests followed, spurred by the evolution of trees that towered 40 and 50 feet tall.

As these tropical forests eventually decayed, they formed dense layers that over millions of years were compacted into coal and petroleum deposits.

Forest 300 Million Years Ago: Falls of the Ohio Interpretive film

Rather than flowering like the trees of Indiana found today, the coal forests of 300 million years ago resembled conifers, reproducing via spores and giant cone structures.

For a hundred million years, these tropical swamps dominated Indiana.

But it wasn't just plants that by now had established themselves on land. Animals followed soon afterwards, led by insects.

Fish too had begun to adapt themselves to life out of water, and as they took advantage of shallow tide pools filled with food, they eventually evolved into the first animals with a backbone:

Amphibians.

These pioneers scurried about, hunting insects, and other small creatures that were quickly following the spread of plants across the landscape

Some left trackways of these journeys, fossilized into rock from the mudflats of a tropical Indiana swamp.



Early Land Animals

They were also among the last animals to leave such records in Indiana, as nearly all of the rock and soil layers that subsequently formed were ultimately eroded away by wind, water and ice.

The geological records of 300 million years, washed away.

The rise and fall of dinosaurs... 65 million years of mammals – all gone.

It is only for the past that fossils are reliably found once again in Indiana: Giant short-faced bears, mammoths, mastodons could be found 20,000 years ago.



Ancient Fossil Coral Reefs at Falls of the Ohio

At this time, Indiana was inhabited by more large animals than exist today in all of Africa.

Caribou, giant ground sloth, huge wolves and bison, and dozens of other animals larger than 100 pounds teemed across the grasslands and forests of this era.

However, the climate at this time was in transition, and Indiana was in the middle of the ice age.



Glaciers

Over two million years, several different periods of glaciations occurred, advancing into southern Indiana.

The ice was often thousands of feet thick, and conditions were harsh at or near the ice front. Tundra plants today found in the Arctic carpeted areas near the glacier.

At these times, mammoths grazed on the grasses and other succulent plants that were dominant.

But at other times, spruce forests grew in parklands, which stood in the shadows of the glaciers themselves.

This was because, despite the presence of glaciers, southern Indiana was warm enough in the summer so that they melted as fast as they advanced.

During their multiple advances and retreats, the ice scoured away much of the landscape, and deposited billions of tons of rock and gravel, carried down from Canada.

Today, these layers can be many hundreds of feet thick.

With the approach of the last great glaciers, the days of large Ice Age creatures of Indiana were numbered.

Perhaps the shifting climate was enough to drive the giant animals into extinction, as their preferred plants and prey became scarce or disappeared altogether

But the first appearance of another large mammal in Indiana may have also played a role.

Humans arrived from Asia towards the end of the ice age.

Whatever the combined impact of over-hunting, introduced diseases, and climate shift, all of the ice age fauna became extinct, both in Indiana and North America...all relatively soon after the arrival of people.



Glacial Meltwater

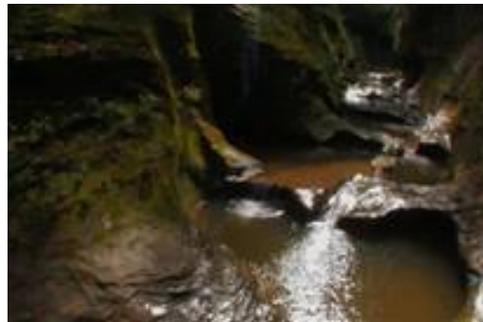
As the final glacier melted, sending a flood of water and rock across the landscape, a new Indiana at last appeared.

10,000 years after the ice age, the glaciers have long since disappeared.

But signs of their passage are everywhere, written across the landscape.

Great floods of melt water carved gorges and canyons along the middle reaches of the Wabash River.

In some areas, sandstone cliffs tower over 100 feet above the surrounding creek bottoms.



Fall Creek Gorge

Nearby, the terrain is gentler, as it rolls to the horizon. Where once an ice cap a mile thick lay heavy upon the ground, now a softened landscape is covered by tall grass prairie.

For 2 million years, the ice advanced and retreated across Indiana.

These multiple advances, wave after wave, came in different forms. Some advanced across the entire state, burying it under thousands of feet of ice.

At other times, the ice flowed quickly in shallow tongues across a front only 50 miles wide, then just as quickly melted away.

Each time, the ice dug a little deeper, and changed the land a little more.

When the last blocks of stranded ice had at last melted, the landscape of the Indiana of today was at last revealed.



The glaciers scoured most of the state, but in the southern highlands and knobs, a reminder remains to suggest what the state once looked like.

And while the ridges and plateaus that rise from its banks are millions of years old, the Ohio River that flows at their base is relatively new. Its valley formed along the southern edge of the ice, as melt water dug much of its present day course.

In the process, bedrock was exposed at a series of rapids, known today as the Falls of the Ohio. These rocks contain the fossilized remains of a time when Indiana was the floor of a tropical sea, 300 millions years in the past.

But the most dominant feature of Indiana before modern times were the seemingly endless stretch of forests.

They covered over 80% of the state's 23 million acres, with trees that topped 200 feet.



Hoosier National Forest

Water flowed freely across the state, not only in the big rivers, but in thousands of miles of streams and creeks that meandered through flat marshlands, as well as the bottom of steep valleys.

And in the north, there was the Kankakee, the flowing river at the heart of one of the largest wetlands in North America, rivaling the everglades in size.



Lake Michigan

But perhaps the single most striking feature of Indiana was a much larger body of water...

Native Americans called it Mikesen – the large lake.

Its basin was scoured out by glaciers, and soon filled with their melt water.

In time, it became the southernmost point of the largest system of freshwater on earth, the Great Lakes.

Winds from the north drove the waters of the lake onto the shores of Indiana.

The dunes that march inland from the water's edge are a record of the rise and fall of Lake Michigan over the past 10,000 years.

These sands were dynamic, and ebbed and flowed with the wind.



Indiana Lakeshore

The gusts that blew in from the lake eventually sculpted a few into giants, which towered up to 200 feet tall.



Indiana Dunes, Mt. Baldy

But the movement and life of individual dunes weren't permanent, as grasses and plants take root, and help to stabilize them over time.

Because of the unique landscape, hundreds of miles from the nearest ocean; plants more at home along the Atlantic coast were able to thrive in the newly created dunes, as long as they, or their seeds, could first hitch a ride.

Inland, the sand and grassy hills dropped down into the oak forests, which dominated the area's dry, sandy soils. The trees themselves grew atop smaller dunes that had become vegetated over time. These dunes dropped down into the depressed swales, where water ponded and marshes formed.

The dune and swale terrain undulated up and down, for miles inland, and were the remnants of ancient beaches, when the lake was larger, and deeper.

Aquatic plants thrived in the depressed swales, while those that required less water grew on the sandy ridges above.



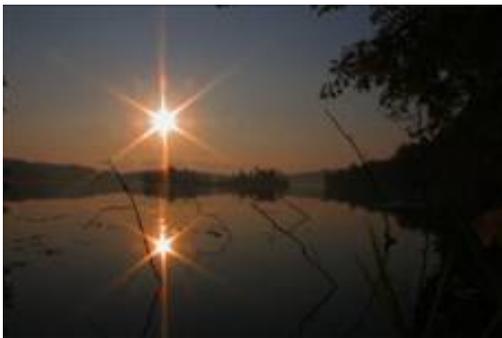
Gross-Succession on Dunes

Prickly pear cactus, perhaps a surprising plant to be a native of Indiana, thrived in the dry, hot conditions of the exposed sand. This close association of wet and dry areas, with marsh plants growing just a few feet from cactus, along with the moderating effects of the lake itself are key reasons why the dunes have one of the most diverse plant communities in America.

At this time, much of the northern part of Indiana was a region half land, and half water.

Lakes, streams, marshes, swamps, and bogs blended together across the landscape.

Many lakes formed when huge blocks of ice were buried in gravel and sediments. As the blocks melted, they left depressions that filled with water.



Olin Lake

Nearby, water flows through saturated soils, fed by nutrient rich waters.

Calcium and other minerals were deposited onto flats, and attracted insects and animals.

Bogs were also common, as lakes filled in with plant material. The water was often very acidic, and mineral poor and plants were challenged to grow in this extreme environment.

Some adapted by taking advantage of a novel source of minerals, and became carnivorous.

Pitcher plants trapped insects in internal pools of digestive fluids, with hairs that funneled them downwards.

Sundews used glands at the end of their leaves, which secrete a sticky resin. Insects that land on the sundew are trapped. Over time, the leaves curl around their prey, and digest them.



Carnivorous Plants

Just along the future border with Ohio was another area dominated by water – the black swamp. This extremely flat plain had been at the bottom of glacial Lake Maumee, the much larger predecessor of modern Lake Erie. After that lake had receded back into Ohio, it left behind clay and silt soils, which drained poorly. A dense swamp formed in its place, with large areas of seasonally standing water. Trees fell into the swamp, and in the summer the air would have been thick with humidity and mosquitoes.

Hundreds, perhaps thousands of bodies of water were large enough to be called lakes, and they dotted the landscape.



Least Terns

Thick forests grew right up to their edge in many cases, and provided perches for fishing birds, such as the kingfisher.

These waters frequently were crystal clear, without the soil runoff seen in the present day that comes from agriculture.

And underneath, the water held a rich array of life.

Scattered on the lake bottoms were fist-sized mussels. These shellfish filtered the water for food, and were to be found all over the state. At this time, Indiana held 77 species, one of the richest assemblages of freshwater shellfish in the world.

Where the water was shallow enough to allow enough sunlight, aquatic plants flourished, and they provided food and shelter for schools of fish.



Mussels

But the largest wetland in Indiana, one of the largest in America, was the grand marsh of the Kankakee.



Kankakee Marsh

With a channel of 250 miles, the Kankakee River meandered along the flat landscape thousands of times, as it flowed over a distance of just 90 miles.

Water flowed through the main channels, and also backed up into countless oxbows, bayous, sloughs, and marshes.

Trees grew on slightly higher ground along the river, as well as in immense swamps.

This was a freshwater marsh that rivaled the everglades in size, and it teemed with wildlife.

Aquatic animals such as beavers were common, and their dams and ponds helped increase the amount of wetlands, in the Kankakee, and everywhere in the state where there was water, and wood for them to feed on.



Beaver

But especially numerous were the birds.

The Indiana of today is impoverished when modern populations are compared to the billions of birds that inhabited the state, or passed through it, 200 years ago.



Shore birds

Cranes roosted in the marshes in the hundreds of thousands as they migrated to and from the gulf coast.

In the spring, shorebirds flocked to the beaches of Lake Michigan in numbers that today can only be seen along the Atlantic coast.

Elsewhere, however, were species of birds unexpected, and in unprecedented numbers.

The Carolina parakeet was a colorful, noisy bird. It was also the northern most species of parrot on earth, and it lived in great numbers in Indiana.

They lived and roosted in large colonies, nesting in hollow trees, and foraged in the nearby forests and fields for seeds and fruits.

However numerous the Carolina parakeets, and other species of birds were in Indiana 200 years ago, their population size paled when compared to what was then the most numerous species of bird on earth: The passenger pigeon.



Carolina Parakeets, Extinct Birds – Indiana State Museum

Similar in appearance to morning doves, passenger pigeons roosted and foraged in forests, much like other birds.

But so numerous were they that the sound of millions of beating wings was like that of a waterfall, and as their gargantuan flocks approached, the sun was blotted out.

These flocks may have held up to a billion birds and could take hours to pass by.

The forests that the pigeons roosted in covered most of the state, and were among the finest temperate woodlands in the world.



Well over a hundred species of trees were native to Indiana, and nearly half of these regularly reached one hundred feet in height. A few exceptional species, such as tulip trees, could reach 200 feet, and were among the tallest living things east of the Rockies.

For its size, Indiana was particularly diverse in trees, and once again, much of this was due to the glaciers.

The central flatlands of the state were the largest natural region of Indiana. All of this area was glaciated, and the landscape was, and is, fairly flat. This was the most common forest type in Indiana. Beech and maple were the dominant species.



Sandhill Cranes

In the spring, these forests exploded with wildflowers, taking advantage of the sun that would soon be blotted out by millions of leaves.

Along tributaries of the middle Wabash River, however, the terrain changed abruptly.

Here, the legacy of the glaciers was more obvious, as water flowed through the deep canyons gouged out by floods of melt water.

Pines and hemlocks towered out of the valley bottoms, as well as on cooler north facing slopes.

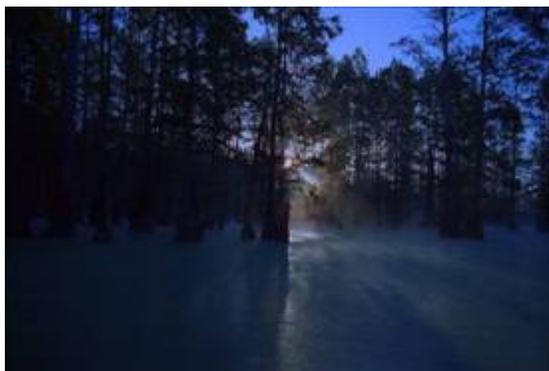
In earlier years, the colder climate of Indiana allowed these types of forests to thrive across the state.

But as the climate warmed, they retreated into the cool moist conditions found along creeks of this type.

Relics of the ice age, they lingered on long after they had disappeared from the rest of Indiana.

They were accompanied by a variety of plants seemingly more suited to Canada, or the Appalachian mountains, than to Indiana.

As the Wabash River flowed south, and neared the Ohio River, another type of forest community absent in the rest of the state began to appear.



Cypress Swamp: Falls of the Ohio Interpretive Film

Cypress trees 150 feet tall and 10 feet or more in diameter covered tens of thousands of acres along the lower Wabash River,

These sloughs and swamps, common in the south along Mississippi river and its tributaries, reached to nearly their northern most extent in Indiana.

These trees, related to redwoods, took root in times of low water, then flourished when the waters rose around them.

The spider lily, which has one of the largest flowers of any native plant, could be found growing a few feet from these vast swamps. Southern species such as these gave the region a feel of the Gulf Coast, rather than of Indiana.



Just 50 miles from these southern influenced swamps, the terrain became more rugged, the plant communities different.



Here, where the glaciers never reached, waterfalls and valleys had taken thousands and millions of years to form. Many of the plants in this area were at their northern most extent, and were more common in the Appalachian and Cumberland Mountains, which this part of Indiana resembled, on a smaller scale.

On the ridges and slopes, American chestnut trees and oaks dominated the highlands and knobs, which often rose hundreds of feet above the surrounding valleys.

Exposed bedrock was common in the south, and over time, water eroded much of it away. Odd and unexpected formations were formed in this manner.

Pedestal rock stood alone in the forest, the last piece of a cliff that had otherwise eroded and crumbled away.



Table Rock

Water flowed more quickly in the highlands, as it ran downhill from ridges and plateaus.

At Hindustan falls, the white river plunged over a ledge that spanned the entire channel.

And Cataract Falls, Indiana's largest, plunged up to 20 feet where the water had cut deeply into the rocky terrain, and created a series of rapids and waterfalls

Underground, erosion was still at work, and had created some of the most extensive cave systems in America.



Wapiti

Packrats, nearly extinct in the state today, was common on the rock cliffs of the era. But there were also larger animals in the forests of Indiana: Elk.

In the fall, the eerie whistling calls of one of the largest animals in the state echoed through the woods.

While herds wandered throughout the state, males were frequently solitary. They only came together with others when the fall mating season arrived.

Their calls, though, attracted other animals besides elk.

Mountain lions were particularly common in Indiana, as they had a rich prey base to choose from. They can and did hunt elk, but deer were probably an easier meal.

There were probably fewer deer at this time, because the open habitat they do best in was less prevalent in these times of endless, dense forests.

They also were preyed upon, by mountain lions, and other, more organized predators.



Wolves roamed the state in thousands.

The role of predators is crucial in keeping browsing animals, such as deer, in check. Without predators, the numbers of deer and elk would have quickly outstripped the forest's ability to feed them.

The thinner soils of the unglaciated areas were generally poorer than elsewhere, and allowed another unusual type of community to develop – the Barrens.

These areas, openings of grasses and shrubs which featured scattered trees, had thin, sandy soils with exposed bedrock. Plants here were adapted to drier conditions, where the soil was too thin, and water drained away readily.



Coneflowers

But there was another region of Indiana that was chiefly dominated by grasslands, and where trees were few in number.

Here, an immense peninsula of grass, 2 million acres in size, spread its stalks into northwestern Indiana. This was a lobe of the tall grass prairie, the eastern most extension of grasslands that reached across the continent, from Indiana to the Rocky Mountains.

Grasses were dominant, but hundreds of other species grew here as well, producing a floral display that rivaled the spring wildflowers of the forests.

It was not unusual to find 20 species in just a few square feet of ground.

Wide open skies and far horizons were the traits of the prairie. But these lush lands held scores of animal species as well, some those long vanished from Indiana.

In early spring, the grasslands echoed with the mating calls of an animal so linked with the prairie, it was named for them.

These were the prairie chickens.

A type of grouse, male prairie chickens inflated their air sacs, and made hollow, booming sounds to attract females.



Prairie Chicken

Stamping their feet, they would bob up and down, in a little circle they had claimed, trying to catch the attention of a female.

The courtships were competitive, with males staking a territory which they defended from other males.

The dominant ones were at the center of the booming grounds – with lesser males forced to boom from the edges.

When females showed interest, the males displayed themselves with greater urgency

Other birds besides chickens were attracted by the display.

Not all of them, however, were benign.

At the site of a threat, the chickens stopped booming, and crouched low, hoping to escape notice.

But oftentimes, booming, for at least the day, was over.

The prairies occupied most of the new part of the state that wasn't dune or marsh, and smaller patches extended across the northern third of Indiana, almost to the Ohio border.

But it was on the main prairies that the largest animal to live in Indiana since the ice ages could be found:



Bison

These bison were the eastern-most members of the vast herds that covered the Great Plains to the west.

They likely were relatively recent immigrants into the state, perhaps accompanying an extension of prairie that occurred during drier periods, when grasses could out-compete forests.

In Indiana, they migrated from the northern prairie to the Ohio River and beyond, seeking the salt licks of Kentucky.

Out on the Great Plains, they traveled in herds that numbered in the millions. Perhaps 60 million altogether wandered the grassland from Mexico to Canada.

During these journeys, bison attracted the attention of others.

When storms approached, it soon became clear why Native Americans referred to the prairies as the place of fire.



Native Americans lived in Indiana for more than 10,000 years. Except in limited areas around villages, their impact on the landscape was minimal.

One exception, however, was fire, which they used to promote plant growth.

In the fall, when tinder was the driest, the Native Americans were said to set the prairies afire, and the horizon glowed at night from the flames of thousands of acres.

It was into this landscape, into this wilderness, that the first settlers rushed. In little more than a century, they transformed a world that had taken 10,000 years to create.

Much of Indiana's Natural heritage has been lost. But it is perhaps surprising that so much more has survived the onslaught.

Even in the Dunes, the most heavily developed region of the state, areas remain much as they did 200 years ago.



Prairie Sunset

Some things, though, are gone forever. Carolina parakeets and Passenger Pigeons were hunted into extinction. And where once there were millions, today they can only be found on the shelves of museums.

No living person will ever see Indiana as it was: the endless forests, prairies and clear waters that Native Americans experienced for thousands of years.

But significant and spectacular remnants exist across the state, as nature bounces back, often with our help.

In upcoming episodes, we will explore the amazing diversity that exists today throughout the state, as well as look forward to a future that increasingly revives the Indiana that was.

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Evergreen Forest

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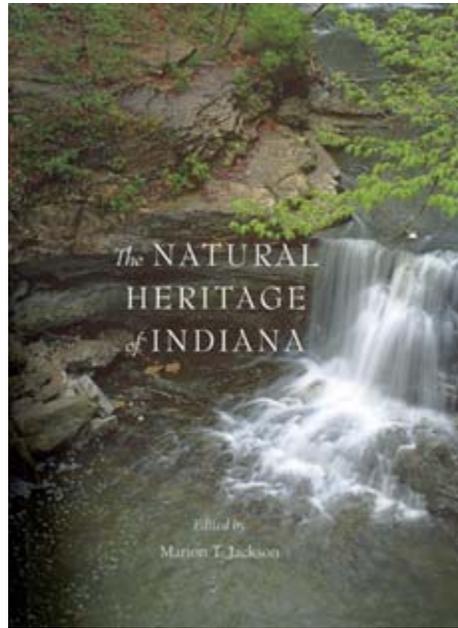
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