THE NATURE OF THINGS

The Benton County Conservation Quarterly Newsletter

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Inside this Issue

Electronic versions and email sign up are available at our website
www.bentoncountyia.gov

10/12/2023
Welcome baby boy Hach!
Proud Parents Heather & Ed

Congratulations to Layla & Ryan on their engagement!

Winged wonders in Figure 1, 2 & 3: "Animals in Flight"!
Photos by Larry Reis

Aerodynamics in Nature

By Ed Hach,
North Unit Park Ranger

Look up in the Midwestern sky during summer days and you'll likely spot turkey vultures soaring overhead or dragonflies zooming above an open space. At dusk, you may be able to see owls and bats begin their nocturnal hunting. You may have noticed this fall that the great seasonal migration of various species of birds and butterflies affords many viewing opportunities of these animals on their way to their wintering grounds to the south. But how exactly is flight possible? It's a question humans have been asking themselves for centuries, and an ability we terrestrials had been seeking to achieve for just as long. Only recently, relatively speaking, have we succeeded in the achievement of flight with the advancement of technology. Aviation has always been a great interest of mine, so much so that at one point in my young adult life, I began attending flight school at Western Michigan University. Though the career path of 'pilot' was one I learned wasn't for me, I still hold special admiration for the field. With what I've learned in my time at WMU's College of Aviation and through general curiosity, I've chosen to write this article on the topic of aerodynamics to show how nature has mastered the skies, influenced human achievements and designs, and how it continues that influence.

So, back to that question: 'how is flight possible?' To understand the science of aerodynamics, one must look at two prominent figures from well over a century before the Wright Brothers succeeded in their first controlled powered flight. The theories of mathematician-physicists Isaac Newton and Daniel Bernoulli work in conjunction to explain the basics of how flying works. Bernoulli's Principle states that when a fluid, in this case air, moves at a greater velocity, the pressure of that air decreases.

Aerodynamics in Nature

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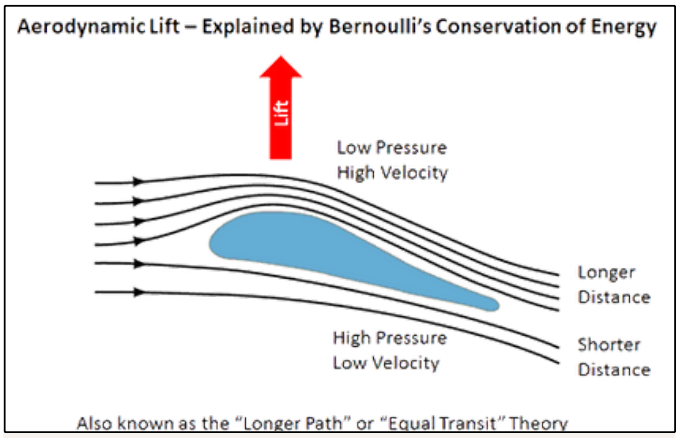

Figure 4: Lift by Bernouilli.
Image from mpoweruk.com/flight_theory.htm

Refer to the image on the left (Figure 4), and you'll see a cross section of a typical shaped wing, also known as an airfoil. In Figure 4, you will see the air moving over the top of the airfoil is forced to move faster than the air below because of the 'hump' in the shape of the wing creating a longer distance for the air to travel. Since the faster air has lower pressure than the air below, this creates lift and the airfoil moves upward.

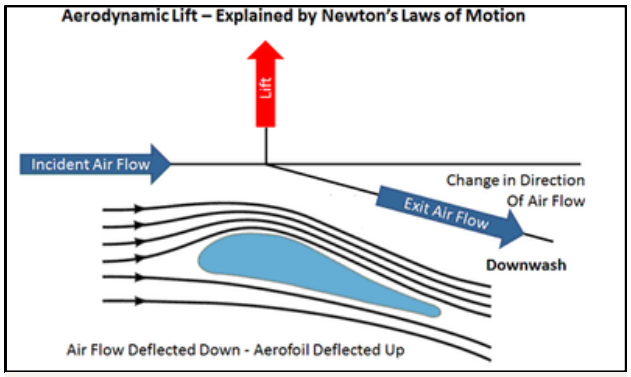

Figure 5: Lift by Newton.
Image from mpoweruk.com/flight_theory.htm

However, this theory alone cannot account for all the science behind flight, as it doesn't show how a plane can fly upside down or how objects like kites and frisbees can fly with their flat shape. Enter Newton's Laws of Motion. While all three laws play a role in aerodynamics, for the sake of time, we'll focus on the third law. Newton's Third Law states that for every action, there is an equal and opposite reaction. Referring to the image on the left (Figure 5), you'll see how this applies. As the flow of air moves around the airfoil, the angle of the airfoil redirects the air downward, which in turn pushes the wing up.

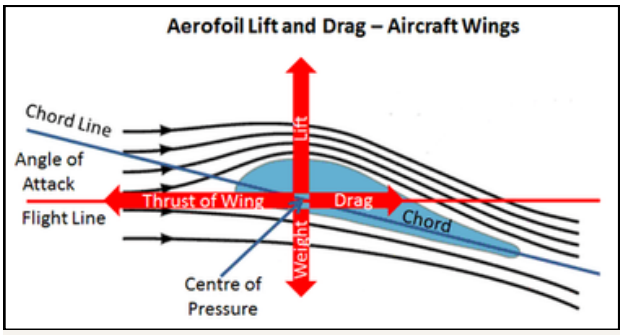

Figure 6: Lift and Drag.
Image from mpoweruk.com/flight_theory.htm

Now these principles explain the force of lift, but with flight, there are three other forces that act upon flying animals and aircraft. Lift is the force that counteracts the force of gravity or weight. For an object to successfully get airborne, it must generate a greater amount of lift relative to its weight. A hummingbird can achieve flight with much less lift than a bald eagle, and those both pale in comparison to the amount of lift needed for a Boeing 747 passenger airplane. But as we've learned, lift is only possible with a flow of air over the wings. Thrust is the force needed to propel the object forward, to produce this airflow. Thrust is generated by birds, insects, and bats by flapping their wings, while man made aircraft are powered by engines that either pull or push the vehicle forward or upward when considering helicopters. But as we can see in Figure 6, thrust is also the force that must counteract the force of drag, or friction against the air. Wing and body shape are crucial in reducing drag, as a highly aerodynamic shape will travel through the air much more efficiently with less disturbance of the airflow.






Aerodynamics in Nature *Continued from previous page*

The most aerodynamic shape is a teardrop. If you look at profile images of some of the most aerodynamic flying animals and aircraft, for example Figure 7 shows a peregrine falcon (the fastest animal in the world) and B-2 stealth aircraft are similarly shaped as their profiles are a teardrop. So, the more efficient the shape, the smaller amount of thrust is needed to overcome drag.

Figure 7: Peregrine falcon & B-2 stealth aircraft. Image from theaviationist.com

For any creature or aircraft to be successful in achieving flight, its thrust must be strong enough to counteract drag, while also achieving enough velocity to create the necessary amount of lift to counteract weight. But you may be thinking: what about when you see birds soaring without flapping their wings for long periods of time? What about wingsuits and flying squirrels, from which their design was inspired? What about paper airplanes, kites, hang-gliders, and glider aircraft? These are all examples of animals and man-made objects taking advantage of natural sources of thrust such as wind, updrafts, and thermals. A frisbee or paper airplane must first get its thrust from being thrown. You'll notice that if it gains a faster airflow, such as being thrown into the wind or gaining momentum through diving, it will stay aloft for longer. As momentum is lost, so is lift, and gravity brings it back to the ground. Gliding objects likewise need some force of initial thrust to get them airborne, whether a glider airplane is towed by a powered plane, or a hang glider or flying squirrel utilize height and gravity. Simply jumping from a high point into the air while gravity gives increasing speed with which to deflect air with an airfoil is enough to keep an object airborne for much longer than falling straight down, even though gliding is in essence, controlled falling.

Figure 8: Flying squirrel in the air

Figure 9: Person free-falling in a wing suit

As for birds that seem to be flying effortlessly while maintaining altitude, these clever creatures use topography and weather to their advantage. When wind or air currents meet landscape features such as hills, dunes, cliffs, or mountain ranges, the flow is diverted up and over the feature. Soaring birds like raptors will find these updrafts to gain velocity and height to continue their flight with minimal thrust input. Many migrating birds and butterflies also use this tactic to "hitch a ride" on atmospheric jet stream currents, taking them greater distances while consuming less energy.

Vultures, condors, storks, and some eagle and hawk species even utilize differences in temperature and air currents to maintain flight. During calmer summer days, you may notice turkey vultures or red-tailed hawks gliding in circles. They are catching what are called thermal updrafts. These thermals are created by uneven heating of air close to the ground, as landscape features absorb solar heat differently. A crop field, pasture, or prairie heats up faster than a forest, lake, or river.

Aerodynamics in Nature

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Figure 10: Turkey Vultures soaring over a corn field

Buildings, roads, and other man-made structures heat up even faster, and when one type of faster heating feature is adjacent to a slower heating source, this creates a column of warmer air rising, and a column of cooler air sinking. Raptors find these warmer thermal updrafts and then turn in circles to stay in them, gaining lift while hardly spending any energy, all so they can focus on their search for food.

Now that we understand the basic principles of flight and have seen how certain creatures use different aspects of aerodynamics, let's look at other natural adaptations winged species have formed to their specific lifestyle needs. We've talked about wing and body shape in terms of aerodynamic efficiency viewed from a profile angle, but let's discuss wing shape in terms of flying style. We know that the shape of a bird's beak can tell us much about its diet. Similarly, the shape of their wings can tell us about various aspects of their lives. Look up at a soaring eagle and you'll notice long, broad wings, with minimal flapping traveling at a steady pace. View a migrating duck and you'll notice shorter, narrower wings with a lot of flapping, traveling at a higher velocity. Watch a gull overhead following a river corridor and you'll notice long, narrow wings with minimal flapping, traveling at a slower speed. Flush a pheasant out of its ground cover and you'll notice short, broad wings constantly flapping, moving at a fairly quick speed, but for a short time as they soon return to land.

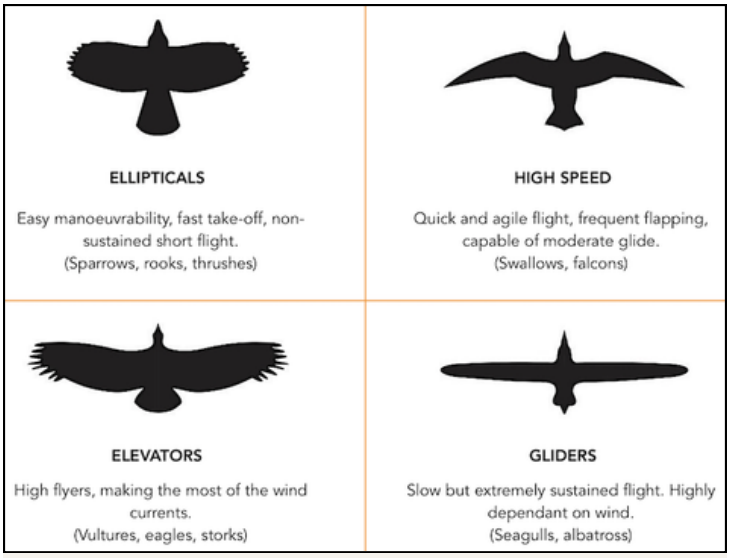

Figure 11: Varying wing shapes of birds

Differing wing shapes offer differing advantages and disadvantages. Long-broad wings (elevators) provide great stability and lift, but less maneuverability. Soaring birds utilize this design in seeking prey that is generally larger and slower: eagles and fish, easy to surprise from above; buteo hawks and rabbits or snakes, or not moving at all; vultures and carrion. Meanwhile short-broad wings (ellipticals) are highly maneuverable and offer maximum thrust for a quick takeoff, but are not ideal for sustained flight. Many songbirds and game birds have this design of wings for quickly getting airborne to escape ground predators, and nimbleness in the air to avoid attacks from aerial predators. Long narrow wings (gliders) are reserved for the masters of long-distance flight, as they provide excellent lift with minimal thrust. Seabirds such as gulls and albatross can remain aloft for hundreds of miles before needing to rest. Though they travel at slow velocity, they take full advantage of ocean wind currents to glide without using much of their own energy. Short narrow wings (high speed) are built for swiftness, as they provide minimal drag as well as maximum agility, but do come at the cost of greater energy needs.

Aerodynamics in Nature

Continued from previous page

Animals that utilize this style use the high speed and maneuverability to catch their small, quick prey. Falcons and accipiter hawks like to dine on smaller birds and often must catch them out of the air, while harriers and short-eared owls pounce on scurrying rodents. Swallows, chimney swifts, and bats use their acrobatic agility to catch flying insects, while other avians like waterfowl and shorebirds make the most out of this wing design to outrun or outmaneuver their would-be predators.

While these are the main aerodynamic designs of mother nature, there are a few other noteworthy adaptations that we should not forget. You may be surprised to learn that in many species of birds, the adolescents will often have slightly longer wingspans than their adult counterparts. Why? As young birds are learning to fly, it is helpful for them to have greater stability until they have gained enough experience. A clever way nature has addressed this need is by the species' genetics growing longer, broader feathers in their youth, and then replacing those feathers with shorter, more maneuverable feathers as they mature. Watch an eagles' nest at the right time and you'll also notice these young flyers-in-training simply facing into a strong wind and opening their wings to learn how to handle lift and drag, without actually taking off.

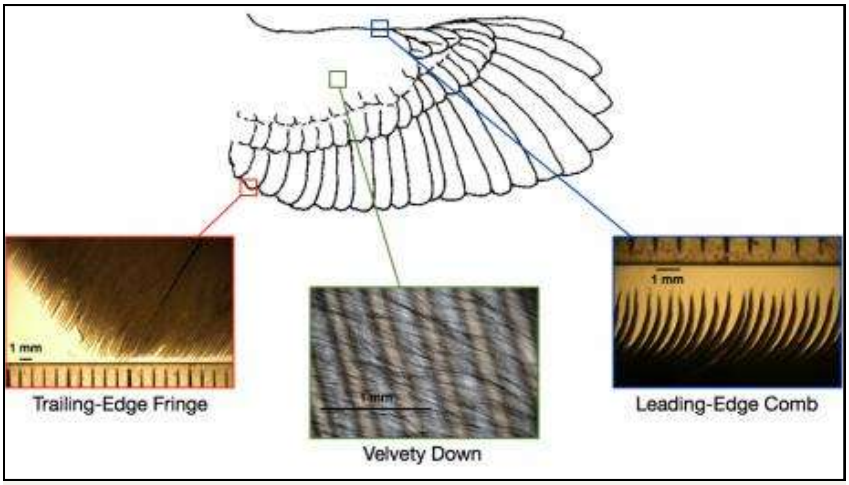

Figure 12: Close up of owl feather adaptations

Another amazing feather adaptation is that of owls' quiet flight. While diurnal raptors like hawks rely more on their eyesight and speed, owls depend more on silence and stealth. For one, noisy flapping of their own wings would make owls' superb hearing useless, as it would also alert their prey to them coming. So, to avoid this, owls have opted for wing structure less reliant on speed, more reliant on lift, and with a couple special adaptations unique to these night time predators. A close-up of owl feathers reveals that the edges of their wings have tiny comb-like patterns designed to soften the disturbance of the air flowing over them. This allows for smoother movement that minimizes any of the "whooshing" sound typically produced by any type of airfoil. Furthermore, owls also have very soft down feathers in places such as their legs to help absorb sound.

Figure 13: Turkey vulture in flight

You may have noticed that turkey vultures fly with their wings bent up in a slight "v" shape. In fact, this is an identifying characteristic to differentiate them from bald eagles at a distance. Turkey vultures do this for extra stability. This ("v") angle is known as a dihedral configuration and it is naturally more stable than a flat or anhedral ("^") configuration, much like a v-bottom boat giving you more stability and control. Since vultures don't have to chase down their food, they can opt for more stable, less maneuverable flight. Since active hunting predators rely on that maneuverability to catch their prey, they choose a less stable wing configuration in order to make quick turns and adjustments.

Aerodynamics in Nature

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Take note of all these adaptations that nature has perfected, and you'll notice that human designs for aircraft have closely followed suit. Airplanes have almost identical wing profiles to that of birds. Different needs of aircraft have borrowed heavily from the wing shapes of birds. Crop dusters, bush planes, training aircraft, and leisure flyers have long, broad wings for increased stability. Military fighter aircraft have short wings and powerful engines for maximum thrust, so they can fly fast and make sharp turns to avoid being shot down. Commercial passenger jets and reconnaissance planes have long, narrow wings to go great distances. Humans have also learned other tricks from our feathered friends, such as glider pilots seeking updrafts and thermals, and aircraft engineers designing training planes with longer wingspans and dihedral configurations for greater safety and stability, while also designing military planes that are naturally unstable to increase maneuverability. We also learned early on in our own aviation ventures that facing into the wind is the most preferred direction for takeoff, because of the increased airflow, which is why aircraft carriers will turn to face the wind to decrease needed distance for their pilots to achieve lift.

Figure 14: American kestrel "kiting"

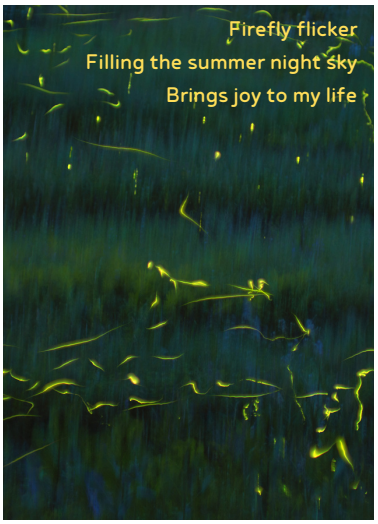
Indeed, mankind has learned everything it knows about aerodynamics from what nature perfected long ago, and we are still learning to this day. Further advancements in technology have made it possible for larger aircraft to be built, but also for smaller flying machines, such as insect sized drones inspired by remarkable flyers like dragonflies. So, next time you spot a crop duster flying over a field, you'll notice the wing shape and its inherent stability. Next time you witness a kestrel hovering over a ditch on a windy day, you'll remember the lift being generated by the gust it is facing into. Next time you throw a paper airplane, you'll notice that it may dive, rebuild speed and lift a couple of times before returning to the ground. Next time a pheasant bursts out in front of you in an explosion of noise and flapping, you'll remember how different it is from an owl's stealthy flight. Hopefully you'll notice many of the various aspects of aerodynamics that nature has on display.

Haiku Challenge

By Benton County Conservation Staff

Webster's Dictionary says haikus are like little Japanese poems, with 17 syllables split into three lines of five, seven, and five syllables each. Usually, they celebrate nature or the beauty of the world around us. So, we're curious: **can YOU write a haiku about nature?** Give it a go and email your masterpiece to info@bentoncountyparks.com. We'll show off our favorites in the newsletter or on our Facebook @bentoncountyparks.

Want some inspiration? Check out these gems created by the BCC team!



Conservation Board Members
Dan Hill: Vinton, Chair
Mike LaGrange: Vinton, Member
Denni Randall: Belle Plaine, Member
Randy Scheel: Garrison, Member
Becky VanWey: Vinton, Member

The Benton County Conservation Board meets the second Monday of every month. Check www.bentoncountyia.gov Times times and locations. Meetings are open to the public.

Conservation Staff
Shelby Williams, Director
Aaron Askelson, Interpretive Naturalist
Faith Hunt, Interpretive Naturalist
Ed Hach, North Unit Ranger
Layla Hagen, East Unit Ranger
Camryn Grubic, South Unit Ranger
Zach Parmater, Conservation Tech/Ranger
Cecilia Dirks, Conservation Tech

Email anyone on staff by using their first initial combined with their last name @bentoncountyparks.com

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To donate visit https://www.bentoncountyia.gov/conservation/donate/

Benton County Conservation
5718 20th Ave Drive
Vinton, IA 52349

Calendar of Events Winter 2023-24

Registration for all events is required by visiting
https://www.mycountyparks.com/County/Benton.aspx unless otherwise stated.

Hannen Lake Ice Fishing Tournament
January 20th, 7AM-11AM; $10 for individuals 16+ & FREE for kids 15 & under
Hannen Lake Park - NEW Shop (1949 Benton Iowa Rd, Blairstown, IA 52209)
Parking/Registration: 6:30AM - Augering/Fishing: 7AM - Raffles & Cash prize: 11AM

Get your fishing gear ready for a frosty fishing frenzy at the Hannen Lake Park Ice Fishing Tournament! Arrival, parking and registration starts at 6:30am with parking available at designated marked areas. Auguring and fishing starting at 7am. Registration will be located at the NEW shop. Individuals 16 and older must present a valid fishing license to participate.
To enter into the tournament, it is $10 for individuals over 16 years old and free for kids 15 and younger. Cash raffles will include Vexilar FL18, 50/50 & more! Prizes will be given to the longest Bluegill, Crappie, & Bass. Cash prize for 16 and older and prizes for 15 and younger. Cash raffles will be sold the day of only. Must be present to win raffles and 1st place fish prize. Breakfast and lunch for sale day of so make sure to bring plenty of cash!

We can't wait to see you January 20th at Hannen Lake Park's NEW SHOP! It'll be an epic ice fishing tournament that'll have you hooked! Visit our Facebook page at Benton County Conservation for more tournament and weather information. Contact South Unit Ranger Grubic with questions at 319-560-9804.

Artistry with Aaron: Gnome Worries
February 24th, 10AM-11:30AM at Nature Center; $30/adult, $15/kid
Is the cold dreary weather making you feel down? Join us at the Nature Center to paint this adorable gnome amongst some spring mushrooms. The painting class will include a 11x14" canvas, materials and step-by-step instruction. No refunds. Registration is required by February 16th by visiting mycountyparks.com

Flora, Fauna & Females: Dutch Oven Cooking
March 8th, 6:30PM at Rodgers Park - Grilling Garden; $10/Person
Celebrate International Women's Day and make some new gal pals along the way! During this program, we will learn how to cook using a Dutch oven by making our own dinner and dessert! This program will include an appetizer, two entrees (with a vegetarian and gluten free option), and desserts. Participants must be 18 years of age or older to participate. BCC will provide warm beverages and all ingredients for food. Participants should dress for the cold weather. While this program is geared towards women, everyone is welcome to join. No refunds. Registration is limited and required before March 4th by visiting www.mycountyparks.com

Building Better Birders
April 13th, 7AM-3:00PM at Nature Center; $20/ per bird house
Benton County Conservation is hosting a Building Better Birders Workshop where bird watchers, "birders," will learn the basics about birding and have a chance to put their knowledge into practice. This is the FINAL Building Better Birder workshop hosted by Benton County Conservation. To learn more about other workshops, visit: https://buildingbetterbirders.com. Registration is required by April 5th, 2024 by visiting https://www.mycountyparks.com/County/Benton.aspx**. If you would like to attend and NOT build a bluebird house, please call us at 319-472-4942 or email info@bentoncountyparks.com to register.**

Come for the whole workshop, or just a portion!
7:00 - 9:00 Welcome at Wildcat Bluff Boat Ramp and birding
9:00 - 10:45 travel / bird at Edna Shain Fen Wildlife Area
10:45 - 12:30 travel to Nature Center / Intro to Wetland bird species presentation
12:30 - 1:30 Lunch
1:30 - 2:30 Build Bluebird boxes
2:30 - 3:00 Questions and wrap up

Building Better Birders
April 13th, 7AM-3:00PM at Nature Center; $20/ per bird house
Building Better Birders Workshop will be conducted by Kelly McKay (BioEco Research and Monitoring Center), with assistance from Mark Roberts (Clinton County Conservation), Brian Ritter & James Wiebler (Nahant Marsh Ed. Center). Funding for this workshop was provided by the Resource Enhancement and Protection – Conservation Education Program (REAP-CEP).

Boundary Waters Canoe Area Youth Trek
July 28 - August 4, 2024; Cost $500/youth (Ages 14-18) - SCHOLARSHIPS AVAILABLE
MANDATORY Training day will be July 18 from 4:30PM-9PM.
Participants will explore the Boundary Waters Canoe Area Wilderness – the most vast wilderness in the lower 48 states and home to loon, moose, wolves, and black bear- in northeast Minnesota. If you have a bit of canoeing experience and the strength and spirit to explore, this trip may be for you! . You will paddle across wilderness lakes, portage canoes and packs, fish for fun and food, read maps and use compasses, live in tents without leaving a trace, cook meals in wilderness areas, and learn about the ecology of this magnificent area. Tents, backpacks, canoes, cooking gear, food, and transportation from Fontana Interpretive Nature Center are all provided. (Maximum of 5 youth to attend).
Stipends and scholarships are available to help offset costs.
The trip is offered in partnership with Buchanan and Benton County Conservation. Register by visiting www.mycountyparks.com/Buchanan

RIVER RAIDERS
JUNE 19-21, 2024

Paddle the Upper Iowa River!
Youth ages 11-13

Adventure awaits around every bend! Youth will canoe, camp, cook outdoors, and learn wilderness skills on this two-night, three-day excursion! Participants will paddle their way around winding bends, rapids, scenic waterfalls, cold springs, and 200-foot chimney bluffs.

Enrollment is limited to 12 participants so this trip fills up very quickly!
Registration opens March 1st, 2024 at
https://www.mycountyparks.com/County/Buchanan.aspx