



NKU | **Research & Education
Field Station**

Biennial Report 2018-2020

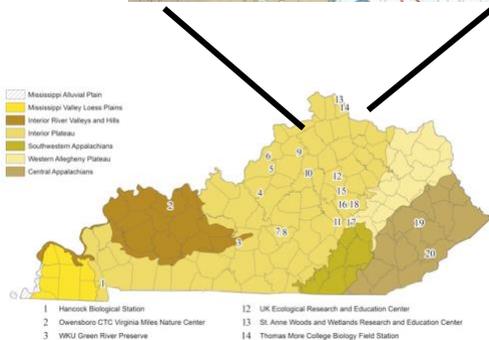
Richard D. Durtsche, *Director*

NKU's Research and Education Field Station (REFS):

The **Research and Education Field Station (REFS)** in Melbourne, KY is 7.1 miles east of the main Northern Kentucky University (NKU) campus in Highland Heights, KY, and is approximately 0.7 miles northwest of Route 8 off Anderson Ave. REFS is a moderately equipped field station and provides opportunities for individuals and groups to receive instruction, conduct research, and experience a range of habitats from the Ohio River, to open and closed canopy wetlands and bottomland forests, to upland mixed mesophytic beech-dominated old growth forests, to open meadowland areas. REFS works with the Campbell County Conservation District (CCCD) to help manage conservation efforts and facilitate the use of the 155 acres of the St. Anne Woods and Wetlands (SAWW) Natural Areas. As a transition zone between the Kentucky bluegrass region to the south and the once glaciated regions across the Ohio River to the north, the diversity of organisms and habitats are extensive. Research and educational opportunities abound with the close proximity to these environments. The main buildings at REFS include the two-story center where classes, research activities, and outreach programs take place, and a new shed building that provides storage for field equipment, will provide work spaces for research and classes, and offers a large covered location for group discussion and activities. The station has fiber-optic Wi-Fi capacity, and the equipment to carry out a variety of field-based studies. The number of university courses with field activities at REFS continues to grow, and extend beyond biology and environmental science courses to include art, theatre, and journalism. Multiple universities and higher education institutions now also visit REFS for their field-based courses. The station offers a variety of short-term courses in wetland management as part of a new professional micro-credential program. Research programs are also expanding beyond invasion biology, herptile biodiversity, ecological restoration, and long-term monitoring to include climate change biology, the physiology of plants in wetlands, freeze-tolerance in frogs and their physiology, pollination ecology, and the breeding biology of mosquitos. As with university coursework, researchers from NKU and an expanding number of other institutions are coming to REFS to do their work. Outreach activities at REFS continue with annual events such as the fall Nature Adventure Day, the spring Earth Day hike, the summer Talk-&-Walk Nature Series, and teacher education programs.



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VISION: To inspire an understanding and appreciation of Northern Kentucky's natural areas from riparian wetlands and the Ohio River, to upland forests and grasslands through time.

MISSION: In support of NKU's mission and core values, REFS serves students, scholars, and the broader community. As a data-driven learning center, REFS fosters regional environmental and ecological research, and is an operations hub for field studies, multidisciplinary nature and outdoor-oriented courses, and interactions between professionals, students, and local citizens.



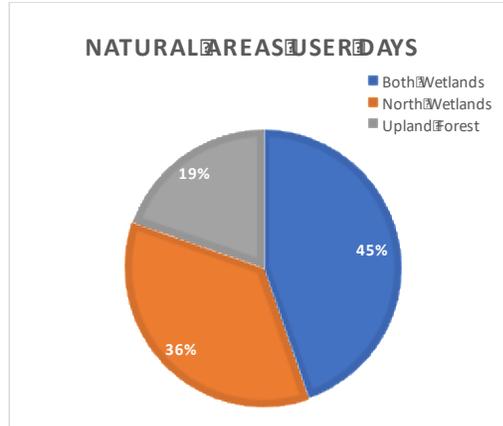
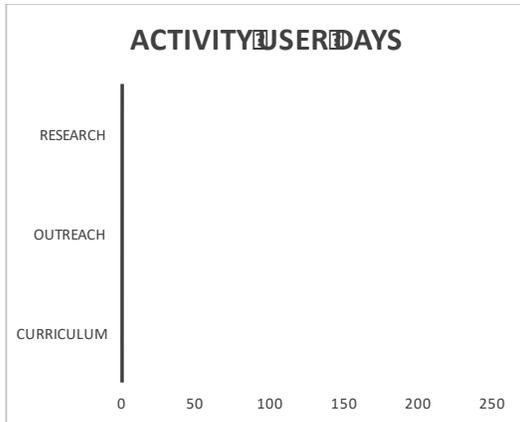
Quarter 1

Reporting Period: July 1 - Sept. 30, 2018

The NKU Research and Education Field Station (REFS) continued research activities, and university curriculum during the first quarter of the 2018-2019 academic year. REFS had several university (NKU) courses that used REFS including the General Ecology Laboratory, Entomology, and Vertebrate Zoology. In addition, Xavier University used the REFS facility and the north wetlands for their Entomology course. Research was carried out throughout the quarter by both Dr. Richard Boyce and Dr. Richard Durtsche on wetland plants, amphibians, invasive species, and long-term monitoring on environmental conditions. We had three Walk-&-Talk activities this quarter including: Introduction to Entomology with Emily Franzen from Xavier University, Trees of Northern Kentucky with Dr. Maggie Whitson from NKU, and Life in Water by Dr. Josh Cooper also from NKU. We wrapped up the quarter with our first annual REFS Nature Adventure Day that was well attended by the community and was part of the Take A Child Outside (TACO) initiative, and the Green Umbrella Great Outdoor Weekend. We also built a small boardwalk in the north wetlands, that was funded by the CCCD.

Sum of # USER Days				
	July	August	September	Grand Total
CURRICULUM				
Both Wetlands		100	112	212
Ecology Lab		100	50	150
North Wetlands			50	150
Entomology			40	40
Entomology Lab			17	17
Upland Forest			23	23
Vertebrate Zoology Lab			22	22
OUTREACH				
North Wetlands	15	11	85	111
RESEARCH				
North Wetlands	10	14	36	60
Grand Total	25	125	233	383

A total of 383 visitors used REFS during the first quarter. Based on these number, 6.5% of users were in July, 32.6% in August, and 60.8% in September. In the first quarter almost half (45.0%) of the activities took place in both wetlands, while 19.0% of the activities were in the uplands. The north wetlands were the most used of the wetlands with 36.0% of the users selecting that as an activity site from all natural areas. From an activity perspective, 55.4.7% of REFS use was for university curriculum, 29.0% for outreach, and 15.6% for research.



Nature Adventure Day 2018



ENV 115: Environmental Science Careers Trail Building



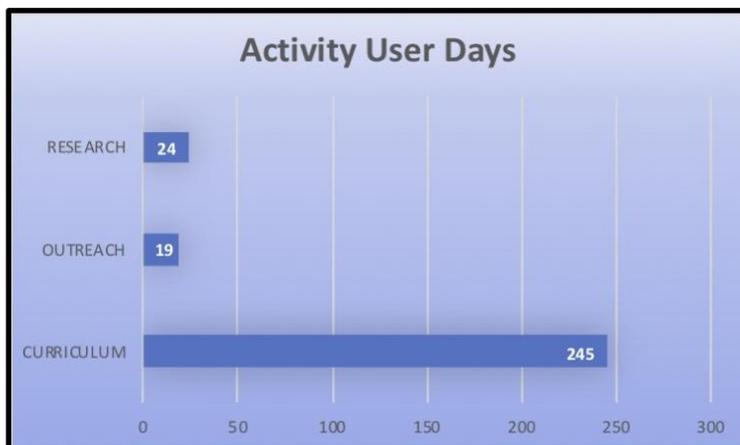
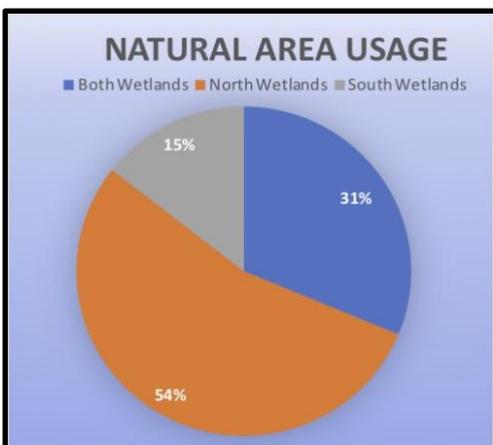
Environmental Science Careers Student: *“Dr. Durtsche did an excellent job explaining the history and purpose of the field station and incorporating us in the preparation work. I look forward to volunteering my services for projects at the station in the future. I like the utility of a research field station and all of the possible collaborations inherent with the space.”*

Quarter 2

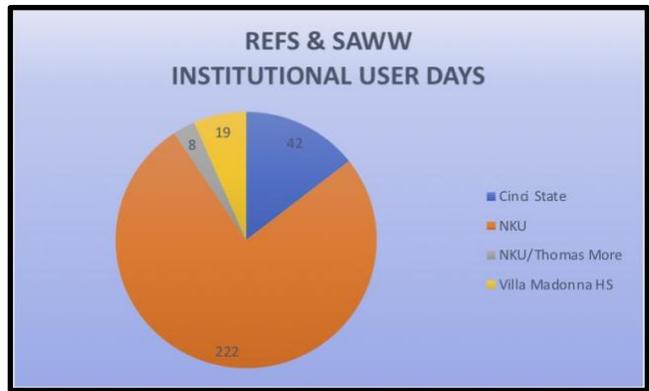
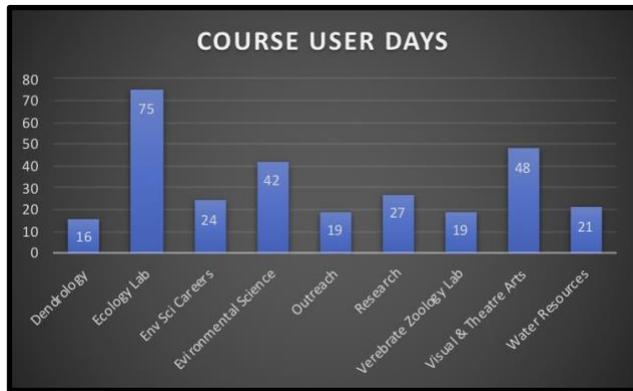
Reporting Period: Oct. 1 - Dec 31, 2018

In the second quarter, REFS continued with research activities, university curriculum, and outreach. There were 288 users during this quarter. The vast majority of the natural area used was the north wetlands (54%) with 15% of usage taking place in the south wetlands, and 31% of the activities using both wetlands. The upland forests and grassland were not used during this quarter. Curriculum use of REFS (85.1%) was the major activity that took place at REFS in the second quarter, with 8.3% of the activities in research, and 6.6% of the activities were outreach programs. On a monthly basis for the second quarter, October had 72.2% of the activity, November had 25.0%, and December had 2.8% of the activity.

Q2				
Row Labels	October	November	December	Grand Total
<input type="checkbox"/> CURRICULUM	179	66		245
Both Wetlands	25	66		91
North Wetlands	93			93
South Wetlands	42			42
Upland Forest	19			19
<input type="checkbox"/> OUTREACH	19			19
North Wetlands	19			19
<input type="checkbox"/> RESEARCH	10	6	8	24
North Wetlands	10	6	8	24
Grand Total	208	72	8	288



REFS and SAWW were used by several university courses including the Dendrology, General Ecology Laboratory, Environmental Science, and Vertebrate Zoology. New to REFS was a course in Visual and Theatre Arts entitled "From Dada to Gaga Costuming & Performance." Research was carried out throughout the quarter by both Dr. Boyce and



Dr. Durtsche on climate measurements, wetland plants, amphibians and reptiles, and changes occurring in the wetlands. REFS hosted a research field trip from the meetings of the Ohio River Basin Consortium of Research and Education (ORBCRE) that was held at Thomas More University in mid-October, and had a Zoology class from Villa Madonna Academy High School visit to learn about the animals of the wetlands. Near the end of November, the new NKU President, Dr. Ashish Vaidya and Dr. Carol Swarts (a friend of REFS) toured the REFS facility and north wetlands to learn more about REFS as a learning and research center for NKU and the Northern Kentucky region.

Villa Madonna Academy Zoology Class Studying Wetland Animals Teacher Molly Miller is NKU Alumni



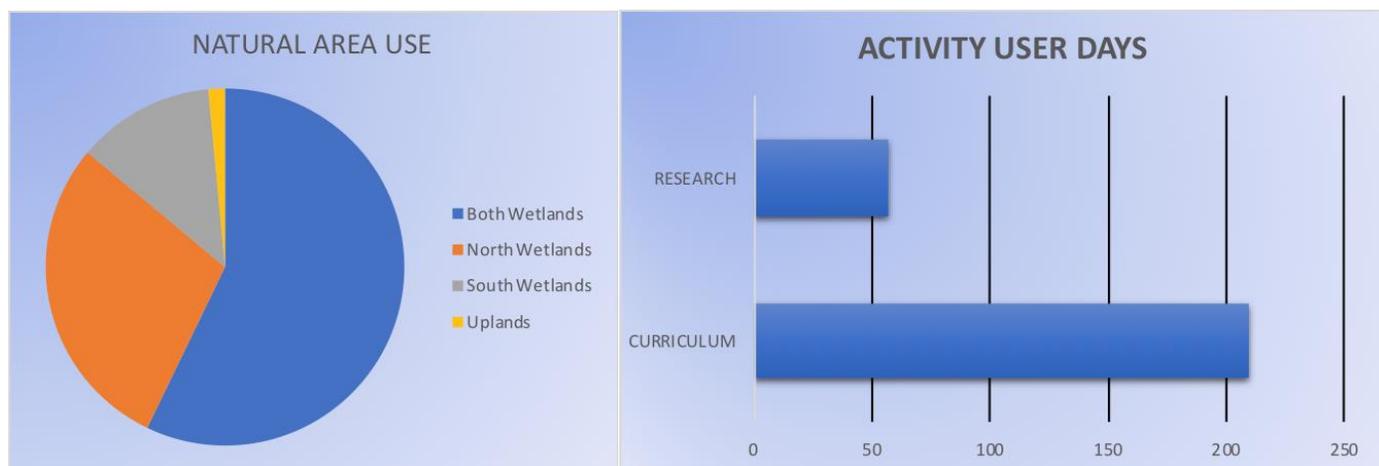
President Vaidya and Dr. Carol Swarts visit REFS!

Quarter 3

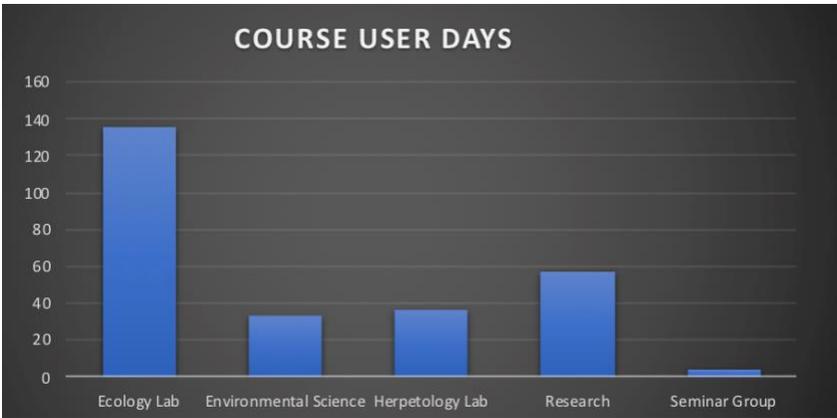
Reporting Period: January 1 - March 31, 2019

The third quarter of activity and usage at REFS continued with research activities and university curriculum. There was a total of 266 users that came to REFS during this quarter. 23.7% of the people using REFS came in January, 38.7% in February, and 37.6% in March. There was more diverse natural area activity during this quarter with over half of the activities in both wetlands (57.1%), while the north wetlands were used by 28.9%, 12.4% used the south wetlands, and only 1.5% used the upland forests. University (predominantly NKU) curriculum again was the major activity (78.6%) during this quarter with research activities at 21.4% of the station activities. There were no outreach programs during this quarter.

Sum of # USER Days Q3				
Month	January	February	March	Grand Total
CURRICULUM	54	83	72	209
Both Wetlands	54	27	55	136
North Wetlands		19	17	36
South Wetlands		33		33
Uplands		4		4
RESEARCH	9	20	28	57
Both Wetlands		5	11	16
North Wetlands	9	15	17	41
Grand Total	63	103	100	266

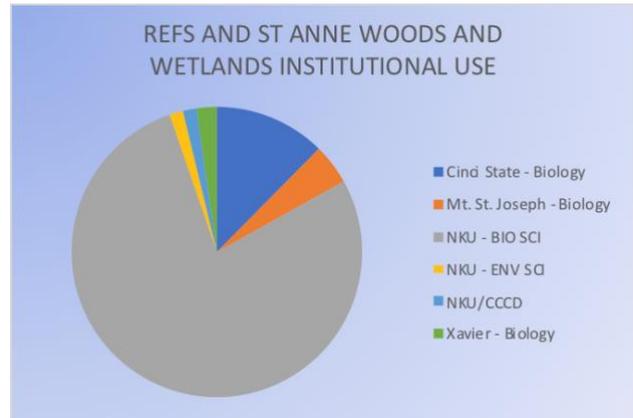


REFS had several university courses use REFS including the General Ecology Laboratory and Herpetology from NKU, and Environmental Sciences from Cincinnati State. Research activities at REFS and Institutional use are expanding at REFS. This spring we initiated



some amphibian research at REFS with Dr. Clara do Amaral from Mt. St. Josephs College that included filming by the BBC for a feature nature program. Xavier University researchers from Dr. Anne Ray's laboratory are back this year for continued

research on the natural populations of long horn beetles. Dr. Richard Boyce has initiated new research into the transpiration rates and sap flow in Eastern Cedar trees, and Dr. Richard Durtsche has continued with a long-term research program on amphibian diversity, breeding phenology, and invasive species in the wetlands. The NKU Center for Environmental Restoration also continues to carry out invasive plant removal in the south wetlands.



Brush Clearing the North Wetlands at REFS January 2019

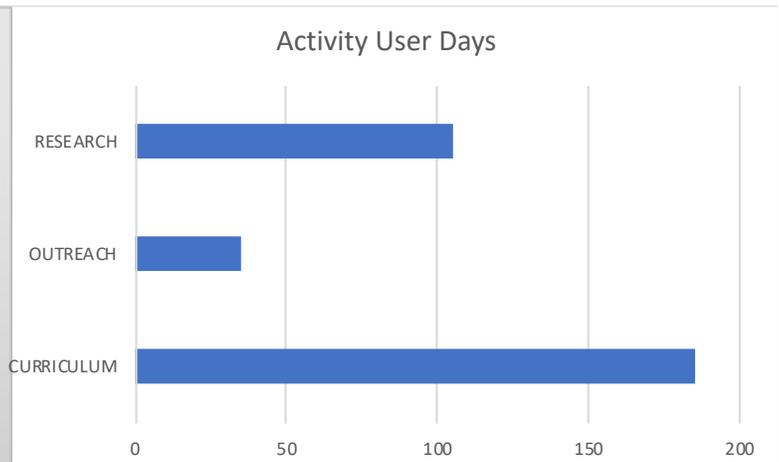
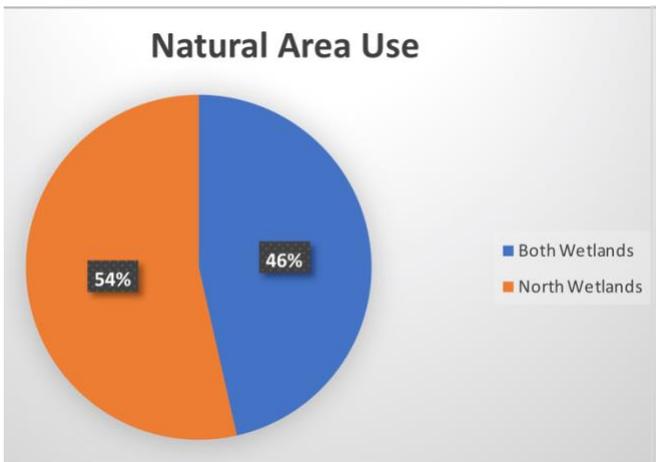


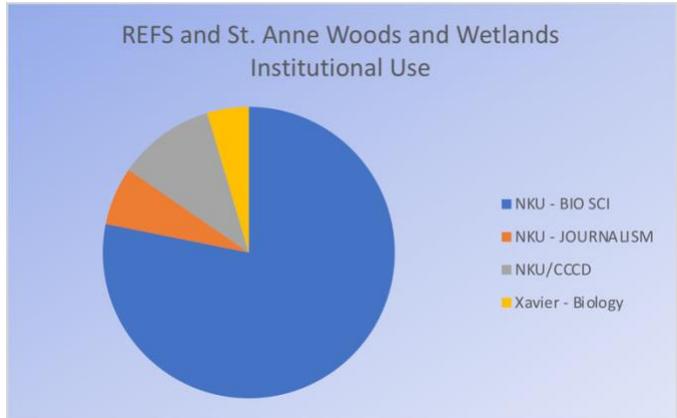
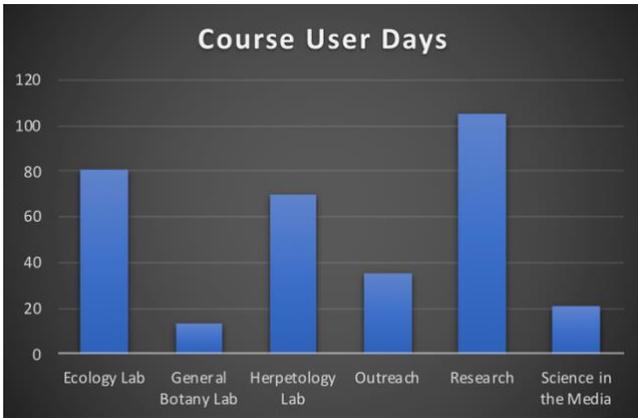
Quarter 4

Reporting Period: April 1 - June 30, 2019

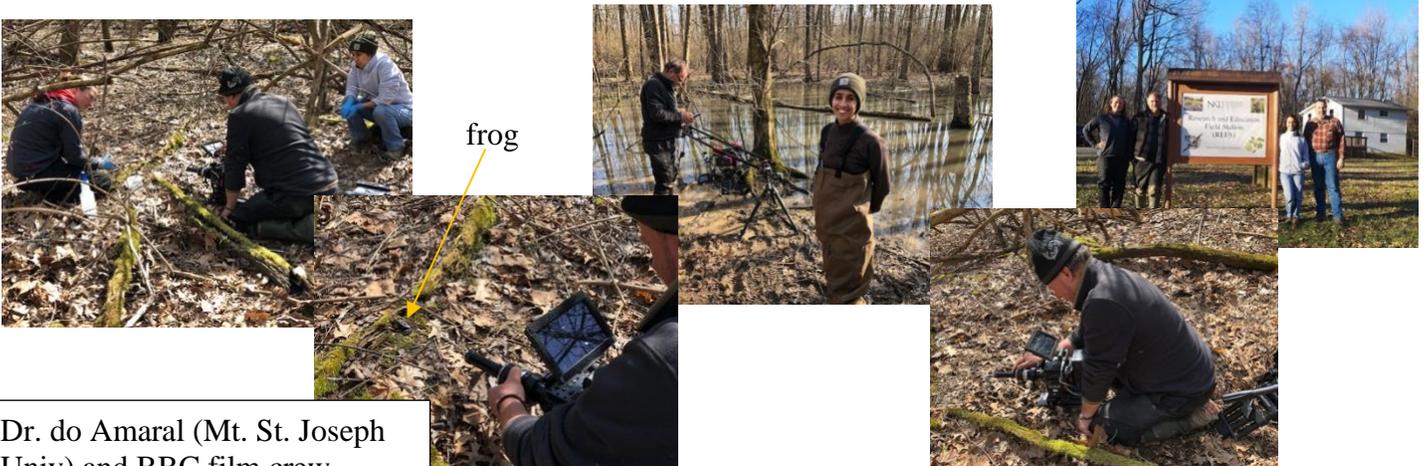
The fourth quarter of this year for REFS was very eventful. REFS continued with activities of research, university curriculum, and outreach activities. There were a total 325 users that visited REFS and SAWW in the fourth quarter. April had 71.4% of the quarter's activity, May had 3.1% of the activity, and June had 25.5% of the activity. The north wetlands were primarily used (54%), followed by both wetlands at 46% or REFS activities. University (NKU) curriculum remained a strong component of the activity in the fourth quarter (56.9%) despite field classes finishing at the end of April. Research activities picked up (32.3%) with the beginning of student summer research projects, and 10.8% of the activities that took place at REFS outreach oriented.

Sum of # USER Days Q4				
Month	April	May	June	Grand Total
<input type="checkbox"/> CURRICULUM	185			185
Both Wetlands	151			151
North Wetlands	34			34
<input type="checkbox"/> OUTREACH	21		14	35
North Wetlands	21		14	35
<input type="checkbox"/> RESEARCH	26	10	69	105
North Wetlands	26	10	69	105
Grand Total	232	10	83	325





REFS had several university courses use REFS including the General Ecology Laboratory, General Botany, and Herpetology from NKU, and Science and the Media from NKU Journalism. Research activities at REFS and Institutional Use continues to expand at REFS. This quarter we continued some amphibian research at REFS with Dr. Clara do Amaral from Mt. St. Josephs College that included filming by the BBC for a feature nature program. Xavier University researchers from Dr. Anne Ray's laboratory continue with their research on the natural populations of long horn beetles. Dr. Richard Boyce has research into the transpiration rates and sap flow in Eastern Cedar trees, and Dr. Richard Durtsche continues with a long-term research program on amphibian diversity, breeding phenology, and a new project looking at the physiology of fish from the nearby 4 mile creek. The NKU Center for Environmental Restoration also continues to carrying out invasive plant removal in the south wetlands. For outreach, NKU REFS and the CCCD jointly hosted an Earth Day event and hike. Despite the somewhat wet weather, there was still a good turn out. The REFS Talks & Walk series has also started with a session on the famous botanist E. Lucy Braun lead by Dr. Maggie Whitson, and a session on Monarch butterflies and their importance as pollinators lead by Michaela Rogers from the KY Fish & Wildlife. REFS has also put in a gravel pad to accept a new storage building that will alleviate some of the equipment storage problems we have had, and will be potential housing for equipment needed by the CCCD for St. Anne Natural Areas management. REFS has also initiated a new professional Micro-Credential Program through NKU on Wetlands Management that will be conducted in the field at SAWW and other locals areas with base instruction at the station.



Dr. do Amaral (Mt. St. Joseph Univ) and BBC film crew – Nature Series on freezing frogs.

REFS

Wetlands Management Professional Micro-credential

Wetlands are a critical part of our ecosystem, abating flooding and regulating waterways. The Northern Kentucky University *Wetlands Management Micro-credential* will provide professionals, students, and anyone interested the knowledge to identify wetland plants, assess wetlands biodiversity assessment, and learn wetlands delineation through investigation of critical areas. These professional short courses will cover criterial and reporting for the Eastern Mountain Piedmont region as well as the Midwest region and be conducted through the NKU Research and Education Field Station (REFS).

SLOS: After completing the Wetlands Management micro-credential, students will have:

- Learned species identification from live and preserved specimens
- Learned field techniques in flagging, mapping and establishing wetlands boundaries; survey techniques using a Trimble® differential GPS; and how to identify hydrology and hydric soil indicators
- Learned standard site survey and habitat quality evaluations (elective)
- Learned both long-term trap station and rapid assessment methods of monitoring amphibians; amphibian species identification from live and preserved specimens and from anuran vocalization; anuran species reproductive phenology assessment using an audio spectrogram program with digital sound files (elective)
- Learned to field-identify invasive species and how to properly control and eradicate invasive species for habitat management (elective)
- Learned mitigation planning and design, aquatic and wetlands permitting and field techniques in habitat restoration (elective)

Micro-credential Course Criteria:

- Wetland Plant Identification (req)
- Wetland Delineation (req)
- One elective

Micro-credential Courses:

WETLANDS PLANT IDENTIFICATION (micro-credential requirement): (3 days)

Learn species identification from live and preserved specimens of wetland plants. Accurate plant identifications are required for vegetative biodiversity assessment, and wetlands mitigation monitoring.

WETLANDS DELINEATION (micro-credential requirement): (5 days)

Learn field techniques in flagging, mapping, and establishing wetlands boundaries according to the 1987 USACE Delineation Manual and current Regional Supplements. Survey techniques will use a state-of-the-art Trimble® differential GPS, and identification of hydrology and hydric soil indicators will be covered.

INVASIVE SPECIES MANAGEMENT AND VEGETATION MONITORING (micro-credential elective): (3 days)

Learn to field identify invasive species. Training on how to properly control and eradicate invasive species for habitat management.

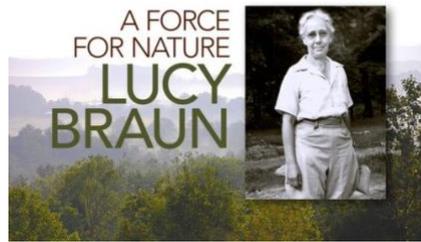
WETLANDS AMPHIBIAN ASSESSMENT - (micro-credential elective): (3 days)

Learn to field identify amphibians in the area by sight, and by call for frogs and toads. Training on how to set up long term monitoring traps stations, and run rapid assessment of amphibian biodiversity in a wetland.

RAPID WETLANDS ASSESSMENT (ORAM/KY-WRAM): 2-3 days (future micro-credential elective)

NATIVE PLANT PROPOGATON: 2-3 days (future micro-credential elective)





Talk-n-Walk Nature Series
Northern Kentucky University's
Research and Education Field Station (REFS)



Thursday Evenings
7-9 pm
Summer 2019

For Information and Registration:
<https://www.nku.edu/refs.html>

- ❖ June 6: E. Lucy Braun – A Force for Nature: a hike through her Melbourne Woods, NKU faculty
- ❖ June 20: Monarchs! – Michaela Rogers, KY Fish and Wildlife
- ❖ July 18: Children of the night: the bats from Kentucky and important services they provide– Luke Dodd, ECU
- ❖ August 1: Summer Wetland Flowers at NKU REFS – Rick Boyce, NKU



REFS Facilities Enhancements:

Two major upgrades occurred at REFS in FY19-FY20.

The first upgrade was the conversion by Cincinnati Bell of the internet service from DSL to fiber-optics via FiOptics. This has increased the speed of research, and education activities and communications. The Wi-Fi associated with the service gives a good signal through the main building, and out as far as the parking lot.

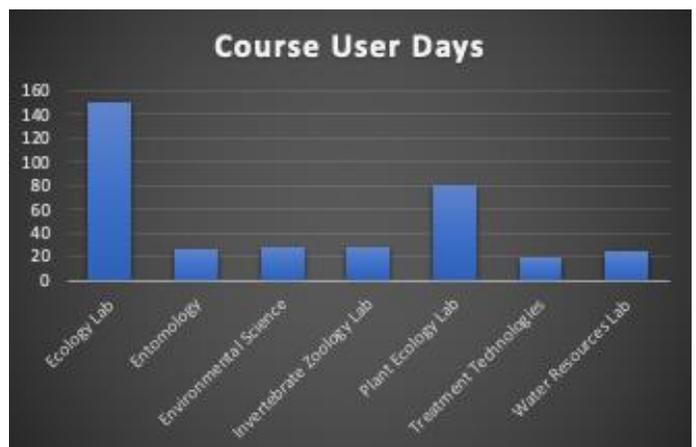
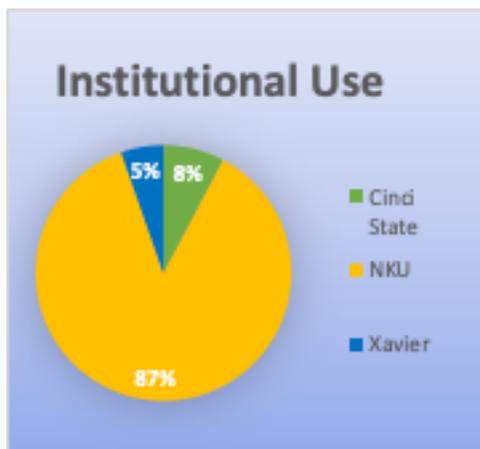
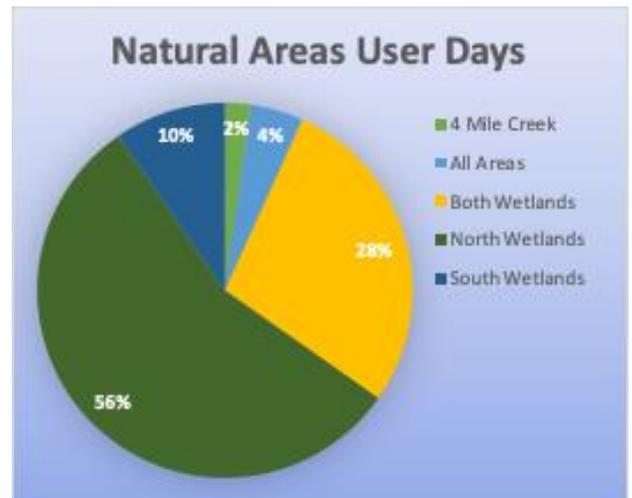
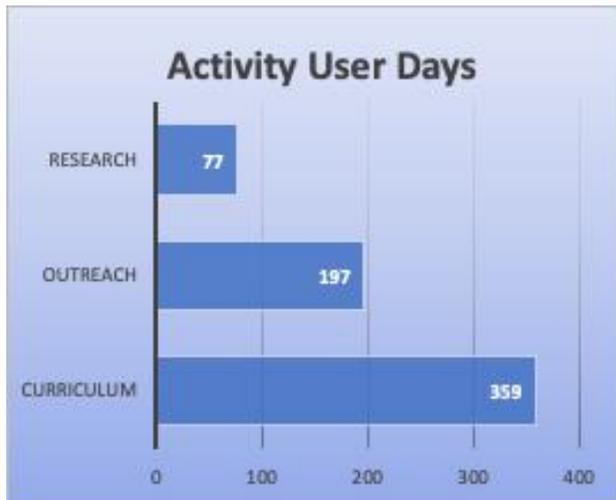
The second major upgrade was the construction of the much-needed shed. This is a metal building that has a footprint of 24' x 35' with 13' height on a side and 16' at the apex. We initially had a crew of volunteer faculty and students that came to help remove sod, and put down ground cloth before the gravel was to be delivered. However, there was too much slope in the landscape, and we decided we needed the services of a bobcat and landscaper. The landscaper leveled two loads of gravel as the pad floor for the shed, and upgraded our parking area and filled pot holes in the road in to REFS. The construction crew arrived in mid-August and installed the metal building with auger anchors in one day. We are currently outfitting the inside of the building for equipment storage, workbench facilities, and a small workshop.



Quarter 1

Reporting Period: July 1 – September 30, 2019

The NKU Research and Education Field Station (REFS) continued research activities, and university curriculum during the first quarter of the 2019-2020 academic year. REFS had several university (NKU) courses that used REFS including the General Ecology Laboratory, Plant Ecology Laboratory, Invertebrate Zoology Laboratory, and Water Resources Laboratory. In addition, Xavier University used the REFS facility and the north wetlands for their Entomology course, and Cincinnati State used REFS and the north and south wetlands for their Environmental Science and Treatment Technologies courses. Research was carried out throughout the quarter by both Dr. Richard Boyce and Dr. Richard Durtsche on wetland plants, amphibians, invasive species, and long-term monitoring on environmental conditions. We had two Walk-&-Talk activities this quarter including: Wetland Flowers by Dr. Richard Boyce from NKU, Children of the Night: the bats from Kentucky and the important services they provide by Dr. Luke Dodd from Eastern Kentucky University. We finished the quarter with our first annual REFS Nature Adventure Day that increases in size every year by the community and was part of the Take A Child Outside (TACO) initiative, and the Green Umbrella Great Outdoor Weekend. The big addition to REFS was the construction of a 24' x 35' shed that was installed in August. This has opened not only much needed storage space, but a location for research, teaching, and outreach activities. REFS and SAWW were also featured in an article about the site in the Cincinnati Magazine (excerpt below). We also washed and painted the main research-education building.



Sum of # USER Days	1st Quarter			Grand Total
	July	August	September	
CURRICULUM		141	218	359
All Areas		25		25
Both Wetlands		116	33	149
North Wetlands			124	124
South Wetlands			61	61
OUTREACH	26	34	137	197
North Wetlands	26	34	137	197
RESEARCH	21	33	23	77
4 Mile Creek	4	10		14
All Areas			4	4
Both Wetlands	14	10	4	28
North Wetlands	3	13	15	31
Grand Total	47	208	378	633

Nature Adventure Day 2019



Cincinnati Magazine Article on REFS and the St. Anne Wetlands

Cincinnati MAGAZINE



Home » News » St. Anne Woods and Wetlands Is a Haven for Wildlife just Minutes...

News

ST. ANNE WOODS AND WETLANDS IS A HAVEN FOR WILDLIFE JUST MINUTES FROM DOWNTOWN

Preserved by nuns and documented by a renowned scientist, St. Anne Woods and Wetlands finds a new life in partnership with Northern Kentucky University.

Michele Day • September 6, 2019

Richard Durtsche is standing in a pond in Melbourne, Kentucky, giving me an impromptu lecture on the amphibians that live in the waters around his boots. Suddenly, his eyes widen and he stops mid-sentence. "Did you hear the 'go-umph?'" he asks with excitement. I shake my head, confused. "That was a green frog," he explains. "It sounds like an unstrung banjo." I listen closely for a few minutes and there it is: "Go-umph."



Maggie Whitson catalogs plants at St. Anne Woods and Wetlands

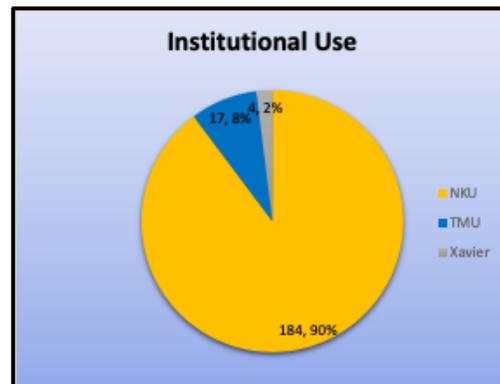
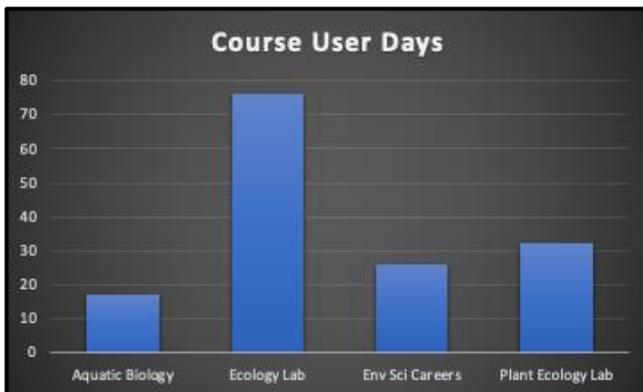
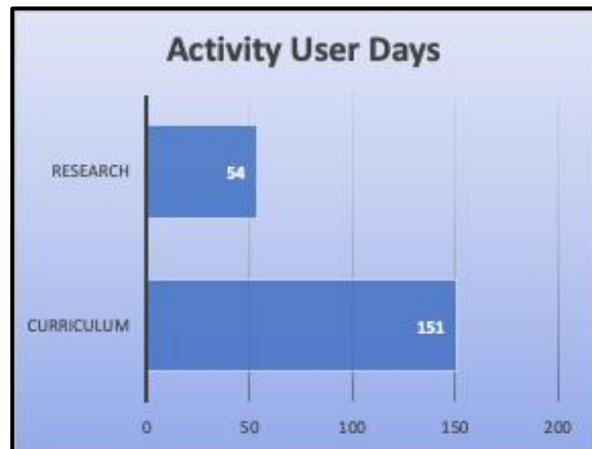
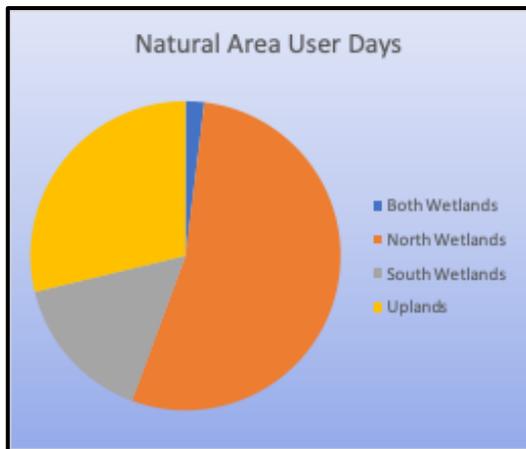
PHOTOGRAPH BY AARON H. CONWAY

If you walk the trails of Melbourne's [St. Anne Woods and Wetlands](#) with Durtsche, you learn to listen for the calls of the frogs. Durtsche, a biological sciences professor at nearby Northern Kentucky University, is director of NKU's [Research and Education Field Station](#). A small house converted into labs and conference space, the station hugs the border of the 155-acre St. Anne nature area, and provides home base for researchers studying

Quarter 2

Reporting Period: October 1 – December 31, 2019

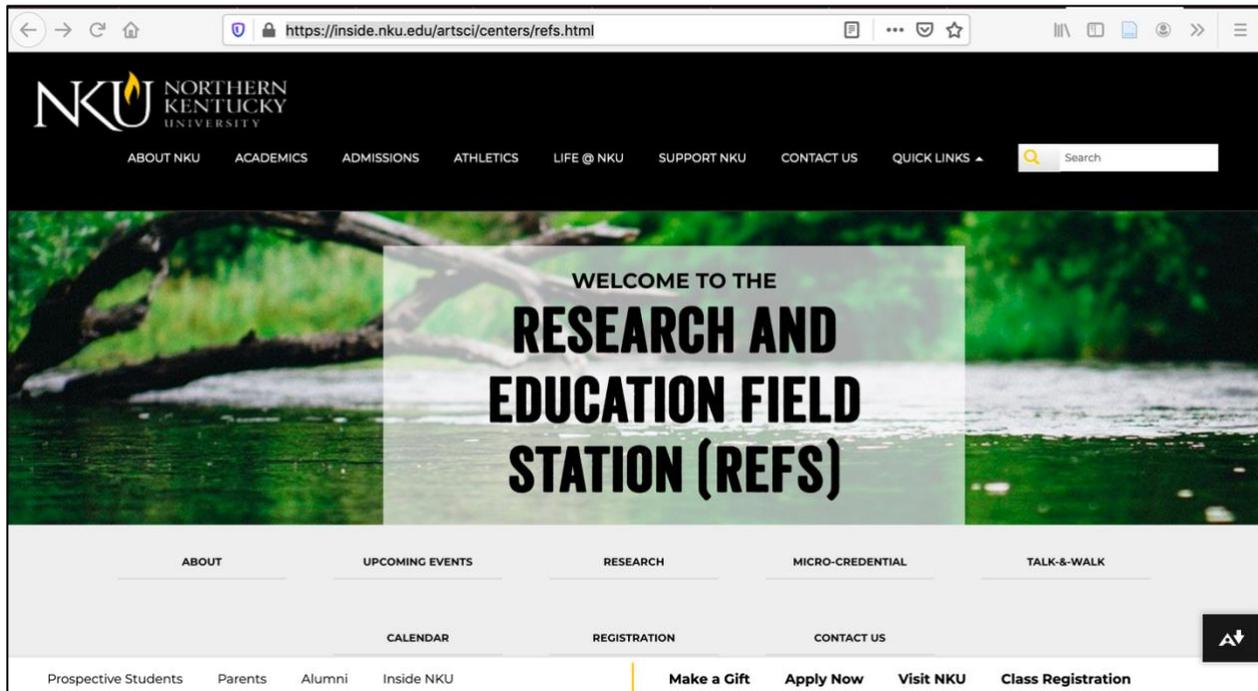
REFS and SAWW were used by several university courses including the General Ecology Laboratory, Environmental Science, and Plant Ecology. New to REFS was a course in Aquatic Biology that was the first time Thomas More University brought a class to visit the station and the north wetlands. Research was carried out throughout the quarter by both Dr. Boyce and Dr. Durtsche on climate measurements, wetland plants, amphibians and reptiles, and changes occurring in the wetlands. The Science Communication (ENV 308



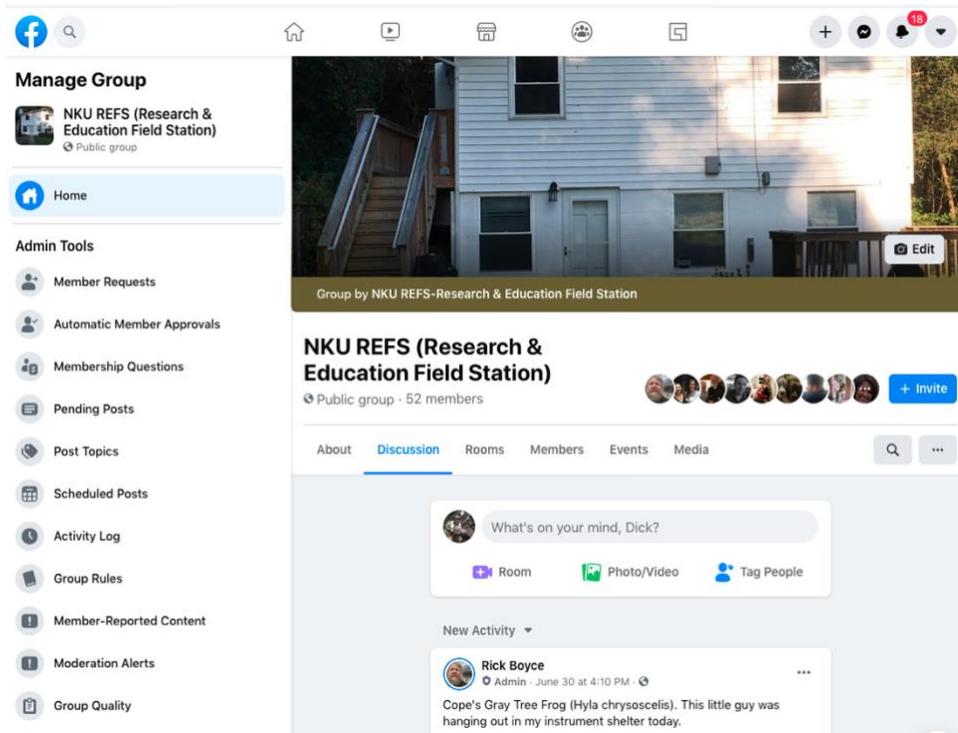
Sum of # USER Days 2nd Quarter				
	October	November	December	Grand Total
CURRICULUM	134	17		151
North Wetlands	60			60
South Wetlands	32			32
Uplands	42	17		59
RESEARCH	25	16	13	54
Both Wetlands	4			4
North Wetlands	21	16	13	50
Grand Total	159	33	13	205

NKU REFS Outreach and Social Media

NKU REFS Website: <https://inside.nku.edu/artsci/centers/refs.html>



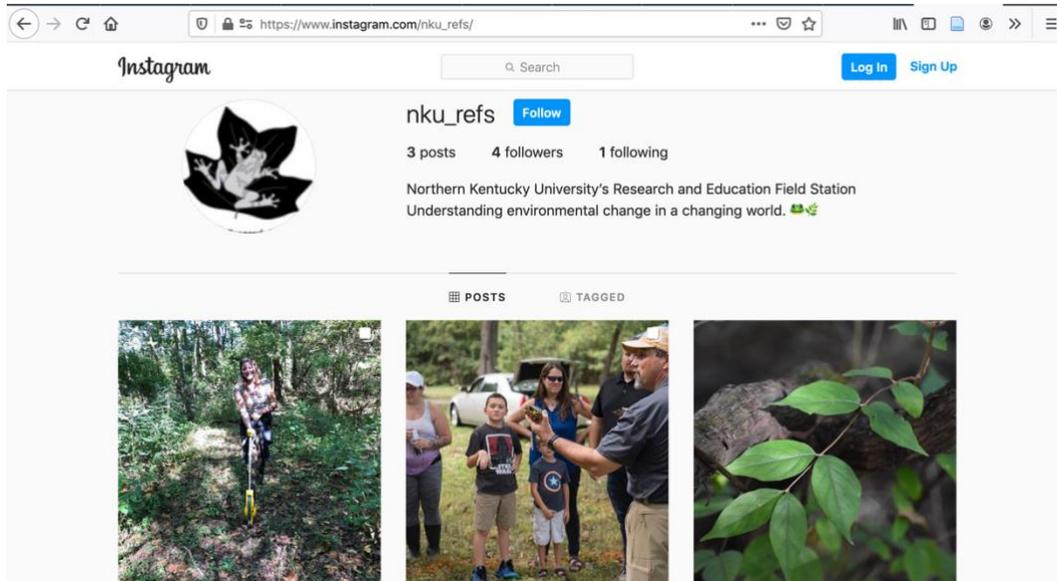
NKU REFS Facebook and Groups:



ENV 308: Science Communication

Select REFS to assist with Social Media and Communication Products

NKU REFS Instagram: https://www.instagram.com/nku_refs/



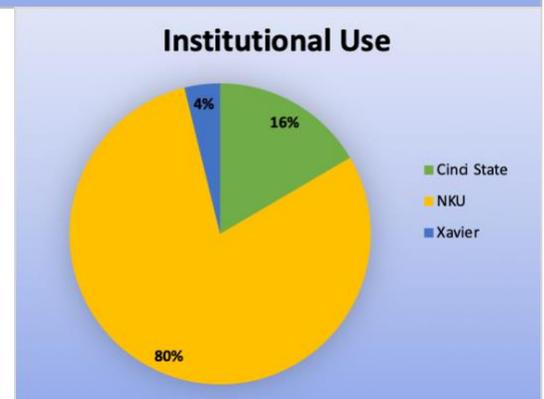
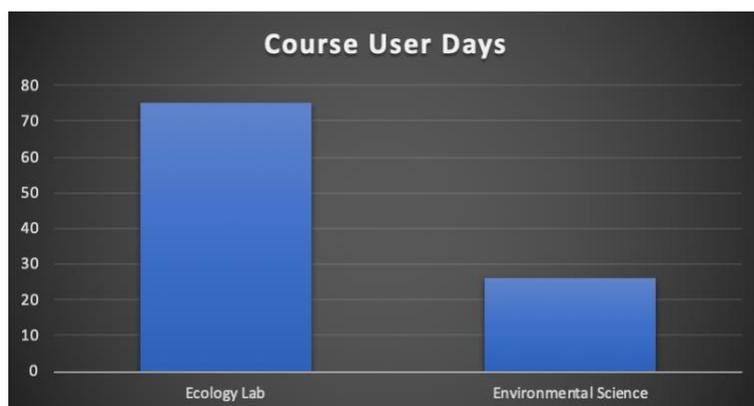
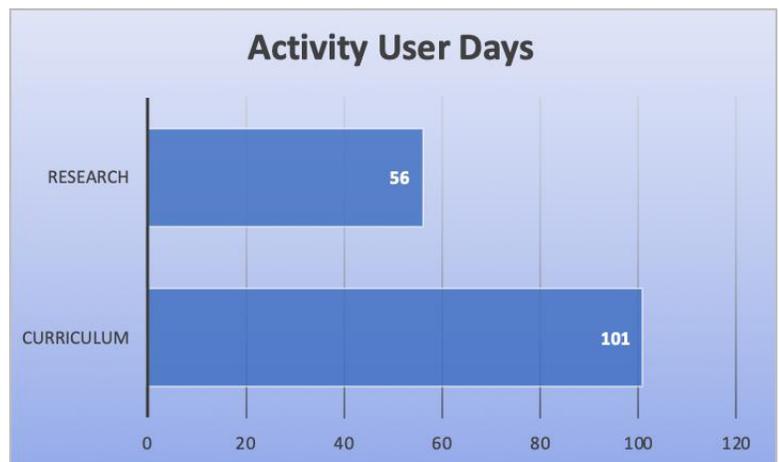
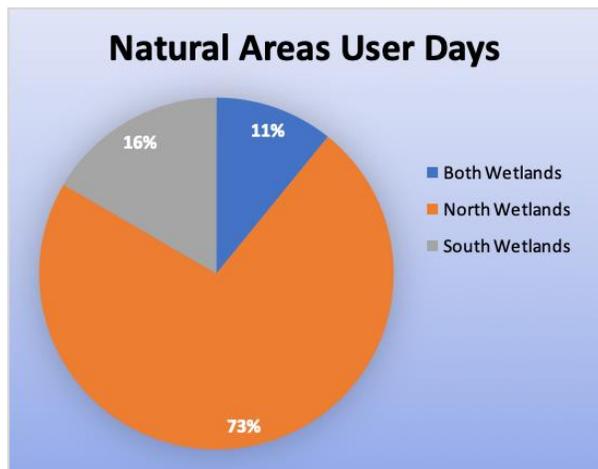
NKU REFS Video and Bookmarks:



Quarter 3

Reporting Period: January 1 – March 31, 2020

The NKU Research and Education Field Station (REFS) continues new, on-going, and long-term research activities, and university curriculum in the St. Anne Woods and Wetlands natural areas. The onset of the COVID-19 Pandemic stopped all university courses after they had just begun using REFS and the St. Anne Woods and Wetlands. General Ecology Laboratory from NKU, and Environmental Sciences from Cincinnati State were the only courses that had been to the station and natural areas before the pandemic hit. Research activities at REFS started the quarter with the limited capacity that winter allows, and continued under pandemic precautions toward the end of the quarter. Long term monitoring of amphibian populations and breeding phenologies (Durtsche) and red cedar sap-flow and photosynthetic rates (Boyce) continued through the quarter as these systems do not shut down in a pandemic like COVID-19. We also addressed control of the aggressive invasive plant, Lesser Celandine from a research perspective in the north wetlands. On much of the population of this plant we used Rodeo (contains glyphosate), but we also tested shade cover, torching, an organic herbicide - pelargonic acid (Scythe), and chipped Amur Honeysuckle (invasive on invasive) as alternative methods of invasive plant control. This study will continue over the next few years to determine the efficacy of these treatments. Xavier University researchers from Dr. Anne Ray's laboratory are back this year for continued research on the natural populations of long horn beetles. There were seven other research programs from Eastern Kentucky University, Mount St. Joseph - University of Cincinnati, University of Findlay, and NKU with approved research applications that were not initiated because of the COVID-19 pandemic.



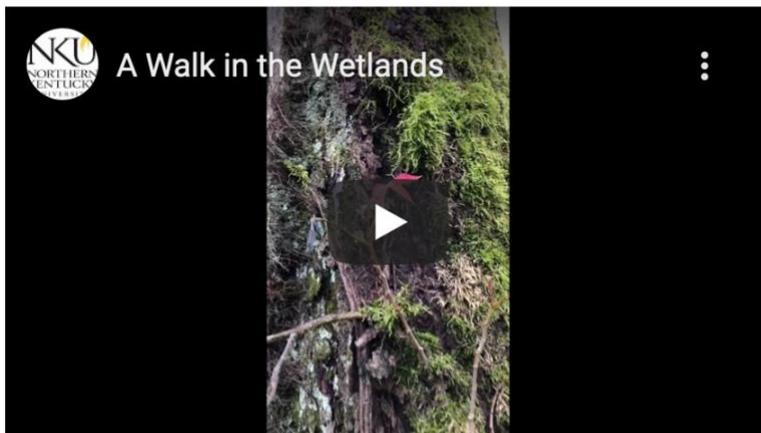
Sum of # USER Days	3rd Quarter			Grand Total
	January	February	March	
CURRICULUM	50	51		101
North Wetlands	50	25		75
South Wetlands		26		26
RESEARCH	16	9	31	56
Both Wetlands	6	5	6	17
North Wetlands	10	4	25	39
Grand Total	66	60	31	157

Lesser Celandine Control Research



Virtual Earth Day Hike at REFS (April 21, 2020) <https://refs.nku.edu>

EARTH DAY 2020



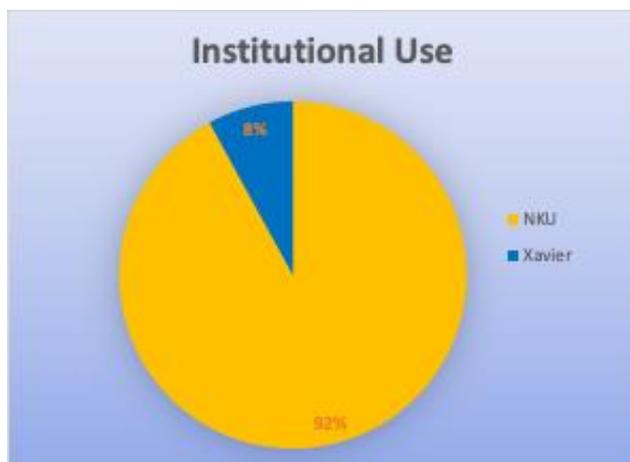
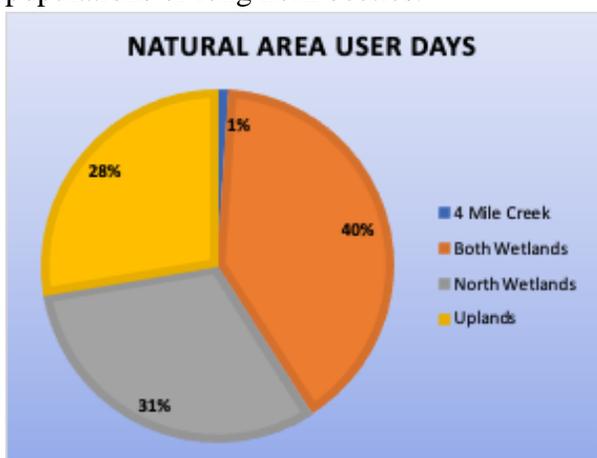
A WALK IN THE WETLANDS.

Join Dr. Richard D. Durtsche on an Earth Day hike through the St. Anne Wetlands.

Quarter 4

Reporting Period: April 1 – June 30, 2020

With the COVID-19 Pandemic raging across the planet, NKU has turned all of its classes to an on-line format. Therefore, there were not any courses taught at REFS or in the St. Anne Woods and Wetlands in the fourth quarter of FY20, and the Wetlands Micro-credentials have been cancelled for the entire summer. Any scheduled outreach activities, such as the annual Earth Day Event and the summer Talk-&-Walk Nature Series were also cancelled. The Earth Day event was replaced with a virtual hike of the south wetlands as a You Tube video that can be viewed through the NKU REFS website (nku.edu/~refs). The NKU Research and Education Field Station (REFS) continues new, on-going, and long-term research activities, and university curriculum in the St. Anne Woods and Wetlands natural areas. Research activities at REFS and in the St. Anne Wood and Wetlands has continued, but only under strict adherence to social distancing and wearing masks guidelines. Research by Dr. Boyce on red cedar photosynthesis, and Amur Honeysuckle blight continue in the plant world. Dr. Durtsche has continued with long term monitoring of amphibian populations, their diversity, and breeding phenology and work on metabolic rates in stream fishes from nearby 4-mile creek. Dr. Allison Parker, a new Assistant Professor at NKU in Environmental Sciences, has begun an intensive study on the abundance, distribution, and breeding of mosquito species in the uplands that could be disease vectors. Xavier University researchers from Dr. Anne Ray's laboratory continue with their research on the natural populations of long horn beetles.



Sum of # USER Days	4th Quarter			Grand Total
	April	May	June	
RESEARCH	37	36	115	188
4 Mile Creek		2		2
Both Wetlands	23	22	30	75
North Wetlands	14	12	33	59
Uplands			52	52
Grand Total	37	36	115	188

Field Research in the Age of COVID-19 at REFS



Dr. Richard Durtsche's students conducting field biodiversity assessment on amphibians in the wetlands.



Dr. Allison Parker checking mosquito egg rafts for species identification from field samples.

Dr. Richard Boyce with his son and research student taking plant measurements on Amur Honeysuckle infected with Honeysuckle Blight.



Research Activities

Research activities at NKU REFS: FY 2019 and FY 2020

New Research

Northern Kentucky University

Buttressing: Finding similarities of trees with buttress roots in a temperate climate, Dr. Richard L. Boyce and Erin Carleton, Department of Biological Sciences.

Demonstrating Microbial Processes using Winogradsky Columns from Wetland Sediments, Dr. Joshua T. Cooper, Department of Biological Sciences. *Cancelled due to COVID-19.*

Examining the use of microbial communities as indicators of wetland restoration, Dr. Joshua T. Cooper, Department of Biological Sciences. *Cancelled due to COVID-19.*

Aerobic scope in Kentucky stream fishes as a fitness indicator of climate change impacts, Dr. Richard D. Durtsche, Department of Biological Sciences.

Understanding success of pollinator species in prairie restoration, Dr. Kristy Hopfensperger and Dr. Denice Robertson, Department of Biological Sciences. *Cancelled due to COVID-19.*

Mosquito species distribution across an urban-to-rural land-use gradient in northern Kentucky, Dr. Allison Parker, Department of Biological Sciences. *Cancelled due to COVID-19.*

Effect of water level on oviposition choice by *Culex* mosquitoes (Diptera: Culicidae), Dr. Allison Parker, Department of Biological Sciences.

Eastern Kentucky University

Phenotypic Plasticity as a Response to Climate Change in Peripheral Amphibian Populations, Dr. Cy Mott and Aaron Devine, Department of Biology. *Cancelled due to COVID-19.*

Mount St. Joseph University and University of Cincinnati, Clermont

Physiology of Cope's grey treefrogs in their natural habitat, Dr. Maria Clara do Amaral and Dr. José Pedro Sousa do Amaral, Department of Biology and Department of Life and Health Sciences. *Cancelled due to COVID-19.*

University of Findlay

Callery Pear Pollinator Survey, Dr. Benjamin Dolan, Kyle Allor, and Cameron Green, Department of Biology. *Cancelled due to COVID-19.*

Ongoing Research

Northern Kentucky University

Effect of honeysuckle leaf blight on the growth of Amur honeysuckle, Dr. Richard L. Boyce, Department of Biological Sciences.

Sap flow in red cedar (*Juniperus virginiana*) during growing and non-growing seasons at St. Anne Woods & Wetlands, Dr. Richard L. Boyce, Department of Biological Sciences.

Monitoring meteorological and hydrological parameters at St. Anne Woods & Wetlands Ponds, Dr. Richard L. Boyce, Department of Biological Sciences.

Permanent Forest Plot Project, Ecological Research as Education Network (EREN), Dr. Richard L. Boyce, Department of Biological Sciences.

Long Term Monitoring of Amphibian & Reptile Populations at the NKU Research and Education Field Station (REFS) /St. Anne Woods and Wetlands (SAWW), Dr. Richard D. Durtsche, Department of Biological Sciences.

Monitoring Ecosystem Services through the Development of a Novel Automated Trail Counter and Wireless Data Transmission System, Dr. Richard D. Durtsche, Department of Biological Sciences, and Dr. Gang Sun, Department of Electrical Engineering.

Plant diversity and abundance in the St Anne Woods and Wetlands, Dr. Maggie Whitson, Department of Biological Sciences.

University of Louisville

A survey of the tree-dwelling ants of Kentucky, Dr. Steve Yanoviak, Department of Biology

Xavier University

Characterizing the effect of the invasive species *Anoplophora glabripennis* Motschulsky (Coleoptera: Cerambycidae) on the native cerambycid community in the Ohio River valley, Dr. Ann Ray and Emily Franzen, Department of Biology

Kentucky Organization of Field Stations (KOFs): REFS has maintained an active role in KOFs over all four years since the start of REFS. During this time Richard Durtsche has served as both the President and Past-President of KOFs. As an active member, REFS has contributed to a promotional video for field stations across Kentucky, and a source for research, education, and outreach collaborations.

Presentations & Publications: (* indicates an undergraduate researcher)

Northern Kentucky University

Richard L. Boyce, Natalie A. Holsclaw*, Allison A. Jones*, and Nathan J. Boyce*. 2019. The native honeysuckle leaf blight increases leaf loss in invasive Amur honeysuckle. Poster at Ecological Society of America Annual Meeting, Louisville, KY.

Amber Pragar*, Jessica Nienaber*, and Richard Boyce. 2019. Honeysuckle Leaf Blight Effects on Growth of *Lonicera maackii* at NKU REFS. Kentucky Academy of Sciences, Berea, KY.

Richard Osborne*, Richard D. Durtsche, and Gang Sun. 2019. Investigating New Methods for Monitoring Nature Trail Usage, NKU Celebration of Student Research and Creativity.

Kaylee Simmons*, Sam Bauer*, Emily Steele*, and Richard D. Durtsche. 2019. Metabolic Response of *Etheostoma caeruleum*, Rainbow Darters, to Temperature Change. Heather Bullen Summer Research Celebration.

Kaylee Simmons*, Sam Bauer*, and Richard D. Durtsche. 2019. Effects of Temperature Variation on Rainbow Darters' (*Etheostoma caeruleum*), Aerobic Scope. Kentucky Academy of Sciences, Berea, KY. (1st place Zoology Section Poster)

Boyce, R. L. and R. D. Durtsche. (2020). Plant colonization of a restored wetland in northern Kentucky: Contribution of seeding vs. natural sources. *Journal of the Torrey Botanical Society* 147: 9-21.

Boyce, Richard L. 2020. Chlorophyll fluorescence and sap flow in eastern red cedar (*Juniperus virginiana*) over the course of the year. Poster at 2020 ESA meeting (to be delivered in August 2020).

Research Grants / REFS-SAWW Management Funding

Richard D. Durtsche. 2018. Creation of a boardwalk in the north wetlands. - materials
Funding Agency: Campbell County Conservation District Amount: \$258

Richard D. Durtsche, and Gang Sun. 2019. Monitoring Ecosystem Services through the Development of a Novel Automated Trail Counter and Wireless Data Transmission System.
Funding Agency: Campbell County Conservation District Amount: \$1,772

Richard D. Durtsche. 2020. The use of metabolic scope in Kentucky stream fishes as an indicator of climate change impacts and vulnerabilities to stream ecosystem services.
Funding Agency: Kentucky Water Resources Research Institute (KWRRRI) – United States Geological Services (USGS) 104B grant Amount: \$24,009

Richard D. Durtsche, Richard L. Boyce, Steve Castellano, Maggie Whitson. 2020. Lesser Celandine Invasive Plant Control. – supplies and lunch
Funding Agency: Campbell County Conservation District Amount: \$279

Curriculum Activities

Institution	Course
Northern Kentucky University	BIO 301L: Invertebrate Zoology Lab BIO 303L: Vertebrate Zoology Lab BIO 304L: Ecology Lab BIO 309L: Plant Ecology Lab BIO 312: Dendrology Lab BIO 320L: Entomology Lab BIO 392: Techniques of the Biological Sciences BIO 404L: Herpetology Lab BIO 492: Directed Research: Biological Sciences ENV 115: Orientation to Environmental Science Careers ENV 220L: Protecting Water Resources Laboratory ENV 308: Science Communication JOU 305: Science in the Media ART 394-TAR 441: From Dada to Gaga Costuming & Performance
Cincinnati State	EVS 110: Environmental Science EVT 230: Treatment Technologies
Thomas More University	BIO 308L: Aquatic Biology
Xavier University	BIO 271: Introduction to Entomology Lab
REFS	Wetlands Management Micro-credential (cancelled due to COVID-19, summer 2020)

Outreach Activities

Event	Description
Earth Day Hike	Yearly event (2020 was virtual)
Summer Talk-&-Walk Nature Series	5-10 per summer (cancelled in 2020 due to COVID-19)
Nature Adventure Day	Outdoor nature activities for the entire family, yearly starting in fall of 2018. Part of TACO, and the Green Umbrella Great Outdoor Weekend
Project Learning Tree Workshop	Teacher workshop on Project Learning Tree (July 2019)
Kentucky Nature Preserve	Wetland Explorers – Kids and parents. (July 2019)

REFS Budget FY19 – FY20

REFS Operations Budget				
FY 2019				
INCOME		Division	Detailed	Funds
	Foundation	Endowment	Carol Swarts <i>Frogs, Snails, & Lizard Tails</i>	\$25,000.00
	Foundation	Income	Carry Forward from Previous Year	\$3,294.70
		Donations		
			Jerry W Warner with match	\$2,500.00
			Carol Swarts	\$1,000.00
			Villa Madonna Academy	\$200.00
			Anonymous	\$20.00
		Research Fees	BBC - Mt. St. Joseph Univ. filming	\$200.00
		Talk&Walk events	2 from FY 2019, 2 from FY 2020	\$130.00
	Arts & Science	Release time	¼ release time for Director (Fall)	
			TOTAL INCOME	\$32,344.70
EXPENSES		Division	Detailed	Funds
	Security	SimpliSafe	monthly charges (@ \$14.99) x 12 mo.	\$179.88
	Internet	Cinci Bell	monthly charges (variable)	\$471.89
	Fees	OBFS Society	Membership Dues	\$50.00
		KY Habitat Conf	Registration	\$25.00
	Maintenance	Lowe's/Kroger	paint, weed control, cleaning supplies	\$200.79
	Facilities/Field			
	Equip	Kroger	Field Event Food	\$75.63
		Petsmart	Aquarium filter pump	\$20.99
		Campbell		
		Scientific	Replacement Depth Sensor	\$313.82
		Amazon	Terrarium LED light	\$129.95
		Shelter Logic	Replacement tent poles	\$72.01
		Harbor Freight	10'x20' Canopy Tent	\$105.95
		Lowe's	Misc. supplies	\$223.62
	Micro-credential	NKU Printing	Lab books, worksheets, keys	\$424.78
		Amazon	Workshop field supplies	\$300.89
	Renovations	Hilltop Stone	Shed pad gravel - 2 loads	\$739.00
		Martin Solutions	Bobcat excavation and pad leveling	\$500.00
		Lowe's	Shed pad timbers, ground cloth	\$420.01
	Marketing	Am Solutions	t-shirts	\$416.17
	Nature Adv. Day	Kroger	Food	\$77.58
		Consumables	Gift baskets, prizes, supplies	\$137.69
			TOTAL EXPENDITURES	\$4,885.65
			BALANCE	\$2,459.05

REFS Operations Budget

FY 2020

INCOME	Division	Detailed	Funds
	Foundation	Endowment	<i>Frogs, Snails, and Lizard Tails</i>
	Foundation	Income	(Endowment investment gains-losses) \$34,359.65
		Donations	Carry Forward from Previous Year \$2,459.05
			Jerry W Warner with match \$2,400.00
			Carol Swarts (\$25,000 Endowment) \$0.00
			Cassie Brendel - Alumni \$25.00
		Talk&Walk	2 from 2019 \$120.00
		Nature Adv	
		Day	donations \$84.00
	Arts & Science	Release time	¼ release time for Director (Fall & Spr)
			TOTAL INCOME \$5,088.05
EXPENSES	Division	Detailed	Funds
	Security	SimpliSafe	monthly charges (@ \$14.99) x 12 mo. \$149.90
	Internet	Cinci Bell	monthly charges (variable) \$456.31
	Fees	OBFS Society	Membership Dues \$50.00
	Maintenance	Lowe's/Kroger	paint, weed control, cleaning supplies \$297.74
	Facilities/Field Equip	Kroger/Sam's	Field Event Food - supplies-cleaning \$86.84
		Kendall-Hunt	Aquatic Entomology Book - 5th ed \$240.06
		Amazon	Invasive plant control - torch/flapper \$407.41
		Lowe's - HD	ladder \$187.64
	Marketing	Am Solutions	t-shirts, hats - donation \$0.00
	Nature Adv. Day	Consumables	Gift baskets, prizes, supplies, printing \$126.07
			TOTAL EXPENDITURES \$2,001.97
			BALANCE \$3,086.08

REFS Renovation Budget				
FY 2019				
INCOME	Division		Detailed	Funds
	NKU Provost	Renovation Funds	Carry Forward from Previous Year	<u>\$10,878</u>
			TOTAL INCOME	\$10,878
EXPENSES	Division		Detailed	Funds
	Renovations	Bldg. Renovations	Bldg. Renovations	\$0.00
			TOTAL EXPENDITURES	\$0.00
			BALANCE	\$10,878

REFS Renovation Budget				
FY 2020				
INCOME	Division		Detailed	Funds
	NKU Provost	Renovation Funds	Carry Forward from Previous Year	<u>\$10,878</u>
			TOTAL INCOME	\$10,878
EXPENSES	Division		Detailed	Funds
	Renovations	Bldg. Renovations	Handi-Port Shed Construction	\$10,838
			Wilson Manufacturing 24' x 35' with 13' sides	
			TOTAL EXPENDITURES	\$10,838
			BALANCE (returned to Provost)	\$40

REFS Summary Budget

FY 2017 – FY 2020

INCOME	Division	Detailed	Funds
	Grant NKU	NSF-FSML #162466! Planning Grant	\$25,000
	Provost	Renovation Funds Facilities Renovation	\$30,000
	Foundation	Endowment <i>Frogs, Snails, & Lizard Tails</i>	\$34,360
	Foundation	<u>Income</u>	
		Donations	\$12,730
		Fees	\$ 924
		TOTAL INCOME	\$103,014
EXPENSES	Division	Detailed	Funds
	Grant NKU	NSF-FSML #162466! Planning Grant – Direct and Indirect Grant Expenses	\$25,000
	Provost	Renovation Funds Facilities Renovation	\$30,000
	Foundation	Expenses <u>Operations and Programming</u>	<u>\$10,568</u>
		TOTAL EXPENDITURES	\$65,534
		BALANCE	\$37,480



SUMMARY:

The activity at REFS has been increasing over the past two years. During the 2018-2019 year (FY19), REFS had a total of 1290 researcher, students, educators, and public users of the facility and the surrounding natural areas. In FY20, REFS had 1183 users. For the four years REFS has been operational, we have had a total of 4663 users visit.

Research activities have continued to increase over these years in both breadth and scope of studies being conducted with 1085 researcher user days. When the station opened, we had three to four researchers from NKU with studies at SAWW, but that has changed substantially with the facilities offered at REFS. At the end of FY20, we had 19 research studies current and proposed from 19 researchers representing seven different universities. That has meant that research has made up 32% of the annual activities taking place at REFS in FY20, and almost a five-fold increase the number of researchers and projects since REFS opened. Nine of these studies are on-going multi-year studies, and ten are newly proposed. Unfortunately, seven studies have been put on-hold due to the COVID-19 pandemic, but these will resume next year. These projects range from studies only at REFS and SAWW, to regional data collection as in the long-horn beetle project out of Xavier University, to state-wide studies on tree-ants out of the University of Louisville and a study on Honeysuckle leaf blight that will soon include researchers from the University of Kentucky, to research on freezing frogs out of Mount St. Joseph University that was filmed by the BBC for one of their international nature documentaries and for a local media program called “Science Around Cincy.”

University curriculum that use REFS and SAWW for field work and outdoor education included 14 different courses from NKU in five different disciplines from Biology and Environmental Science, to Journalism, and Theatre and Art. Xavier University leads one course, Cincinnati State has 2 courses, and Thomas More University recently brought a class out to experience the wetlands, and to use REFS facilities for teaching. Curriculum has been the major REFS activity (57%) over the past four years. In many cases the experience students have had at REFS have changed their career plans. Unfortunately, much of the coursework to be taught at REFS during the spring of FY20 was cancelled due to COVID_19. We have a new professional Wetlands Management Micro-credential that was scheduled for the spring and summer of FY20 which also had to be cancelled.

The REFS Outreach programs have been successful and offer nature learning and experiences to the community at large. Community engagement is at 20% of the activity at REFS over the past 4 years. We have Earth Day hikes, a summer Talk-&-Walk evening nature series, and a Fall Nature Adventure Day at the end of September as our current annual community events. With COVID-19, our Earth Day hike in the spring of FY20 went virtual, so that while people might not have been able to get outdoors at least a little nature could be brought into their homes. The Talk-&-Walk nature series continues to be a success, and we have provided expert speakers on an array of nature topics over the years. Our Nature Adventure Day in the fall, continues as a success and is growing in size every year. This event is linked with the Green Umbrella’s Great Outdoor Weekend, and is part of the International Take A Child Outside (TACO) week. We also hosted a Wetland Explorers event through the Kentucky Nature Preserve, and a Project Learning Tree Teacher Workshop.

We continue on the path of our NSF funded 5-year Strategic Plan for REFS, and work with our REFS Steering Committee and inform and receive input from our stakeholders as the station continues to grow. With the remaining renovation funds provided by NKU Provost Ott Rowlands and some of our Foundation funds, we were able to complete our new storage building. We are so grateful to her for this contribution. This building will provide the proper storage for field equipment used at REFS and SAWW, have space for education and outreach activities, and will have facilities for researchers to construct field gear and carry out projects indoors. Our income during the two fiscal years (FY17 and FY18) were also benefitted from generous donors, and any monies received from usage fees and outreach activity donations. Dr. Carol Swarts has been a great supporter, and established a generous \$25,000 endowment for REFS entitled the “Frogs, Snails, and Lizard Tails” fund. The FY 20 principle balance on this endowment is now \$35,000. We had over \$6,100 from donors, \$200 in researcher fees, and generated \$330 in fees from our Talk-&-Walk nature series and other non-NKU research activities. Total income for FY19-FY20 was \$20,852. REFS Expenditures (\$17,732) were dominated with renovation costs of the shed (\$10,838). The REFS Director was given ¼ release time from teaching in the fall semester of FY 19, and for both fall and spring semesters of FY 20 which were welcomed for more scheduling, management, and operations work with REFS. Utilities are covered by the NKU Facilities and Maintenance division, and communication and security costs were at 20.9% of the total expenditures for operations. Costs for the gravel pad for the shed and costs for the micro-credential courses are some costs that were non-recurring expenditures from FY2019. The carry-over at the end of FY2020 is \$3,086. We again thank Provost Ott Rowlands for her generous contribution to get NKU’s Research and Education Field Station up and running. We hope that the future brings an increase in the number of users and that contributions grow as we engage with researchers, university curriculum and the public at large.

Submitted by:



Dr. Richard D. Durtsche
Director – NKU Research and Education Field Station (REFS)
Professor of Biological Sciences
July 7, 2020



NKU Research & Education
Field Station

