

ANNUAL REPORT JULY 1, 2019 - JUNE 30, 2020

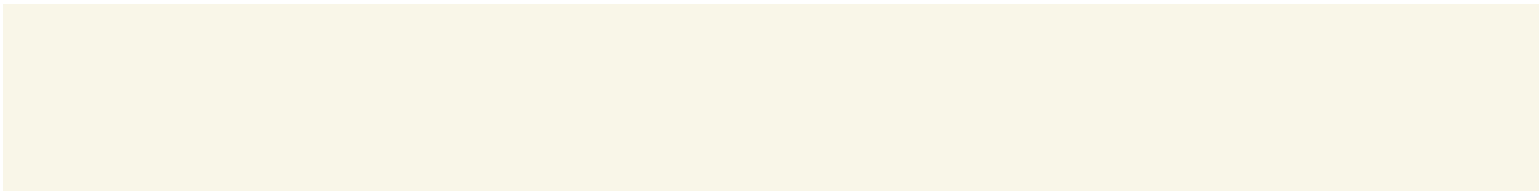
# The American Chestnut Foundation

MEASURING SUCCESS IN AN UNPRECEDENTED YEAR





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I think everyone would agree 2019-2020 will go down in history. The COVID-19 pandemic has disrupted the lives and livelihoods of virtually every American. Our hearts go out to all of the many hundreds of thousands of families who have been affected, and especially those who have lost loved ones.

Throughout the pandemic, the mission of TACF has continued, largely uninterrupted. The staff at the national office demonstrated their incredible commitment and high level of professionalism with an immediate response, shifting to remote work within mere days. Likewise, Meadowview Research Farm staff quickly implemented CDC-compliant protocols to ensure continuation of greenhouse experiments, orchard maintenance, and other land management needs. Staff also moved quickly to maintain operations, chapter field work, and continued to seek out new collaborations to bring us closer to mission success. The entire team at TACF is to be commended for their extraordinary work! While many state chapters delayed or postponed various group activities, volunteers and citizen scientists still managed to conduct critical field work safely without losing ground in their breeding programs.

Against this backdrop, many members of the board and chapter leadership also shifted to remote mode quickly in order to help conduct the business needs of TACF without interruption. The Executive Committee began late March with weekly, and later, monthly meetings to make sure TACF maintained its fluidity, nimbleness, and health as an organization. In many ways, the response has been fascinating. The use of modern technology has allowed us to respond in unique

ways that simply would not have been possible only a decade ago. Videoconferencing platforms permitted our summer and fall Board of Directors meetings to carry on. It also spurred regular informative Chestnut Chats, which have provided a level of engagement around chestnut topics not previously seen within the organization. There are now monthly Executive Leadership Science meetings to discuss strategies for future directions and research needs. A task force dedicated to the deregulation of ESF's Darling 58 spurred tremendous constituency and media outreach. Unanticipated positive outcomes have actually resulted from the pandemic, some of which I see continuing into the future. The prospects for TACF are as strong as ever and our mission continues with a robust and enthusiastic core of staff, volunteers, and collaborators.

Mark your calendars for our fall meeting in Asheville on October 30, 2021. I hope to celebrate our achievements there with you in person!

Sincerely,

A handwritten signature in black ink that reads "Brian C. McCarthy".

Brian C. McCarthy  
Chairman, Board of Directors



## 2020 ANNUAL SCIENCE REPORT

# Progressing in Our Mission

Despite the challenges that the pandemic has posed for our volunteers, staff, and academic collaborators, we continue to progress in our mission to incorporate disease resistance into a genetically diverse population of American chestnut.

### BACKCROSS BREEDING

At Meadowview Research Farms, TACF staff completed selection of the 1% most blight resistant backcross trees in two seed orchards. It has taken more than 18 years to plant, inoculate, and assess over 60,000 trees in these seed orchards for blight resistance. As of 2019, there were approximately 3,500 trees remaining in these orchards. Over the last two winters, Meadowview Research Farm staff culled approximately 2,200 trees to complete selection of the most blight-resistant trees in both seed orchards. Through DNA analysis, we learned that the selected backcross tree inherited between 60% and 99% (average 80%) of their genome from

American chestnut. The selected trees have blight resistance that is slightly less than  $F_1$  (50/50) hybrids between Chinese chestnut and American chestnut. Results imply that blight resistance is controlled by more genes than previously assumed and that backcross trees inherited different subsets of these genes. Some of the selected backcross trees are pictured in **Figure 1**.

The good news is that many of the blight resistance genes from the Chinese chestnut founders are likely still present in the American chestnut backcross populations. By crossing the most resistant from the current generation together and stringently and accurately selecting for blight

resistance among their progeny, we will continue to improve the blight resistance in these populations. To speed up additional generation(s) of selection, we have begun testing a non-destructive method to screen backcross seedlings for blight resistance that was developed by Martin Cipollini at Berry College. Using this method, we cut off a portion of the central leader of the seedlings, inoculate the stem tips with chestnut blight, measure canker growth after three months, and then cut off the blighted portion of the stem prior to planting in the field (**Figure 2**). We hope this method can help identify and eliminate at least half of the most susceptible seedlings



**FIGURE 1:** (A) American chestnut that is susceptible to chestnut blight. (B) A partially resistant American chestnut backcross tree that inherited 93% of its genome from American chestnut and 7% from Chinese chestnut. (C) One of our most promising backcross selections that inherited 83% of its genome from American chestnut. (D) A highly resistant pseudo-F1 hybrid that inherited 42% of its genome from American chestnut and 58% from Chinese chestnut.

prior to planting in the field without killing the more resistant seedlings.

In TACF's chapter breeding programs, we are assessing long-term blight resistance of American chestnut backcross trees to more stringently select the most resistant parents. Since 1996, our chapters have inoculated more than ten

thousand third and fourth generation American chestnut backcross trees with the chestnut blight fungus. To date, approximately 10% or 1,000 trees have been selected based on canker severity six months to a year after inoculation. We intend to further narrow down the chapter backcross population by removing trees that demonstrate signs of

susceptibility that typically take two or more years to develop, such as the death of the main inoculated stem. Backcross trees that we do not select may harbor genetic diversity from unique American chestnut parents. We plan to conserve this diversity by crossing the non-selected backcross trees with blight-tolerant Darling 58 transgenic trees.

## DIVERSIFYING TRANSGENIC BLIGHT-TOLERANT AMERICAN CHESTNUTS



**FIGURE 2:** The alternative small stem assay whereby we inoculate stem tips with chestnut blight, measure the cankers after 90 days, and cut off the cankers. This method potentially enables us to eliminate the most susceptible seedlings prior to planting in the field. (Alternative small stem assay method developed by Martin Cipollini.)

In 2019, William Powell's lab at SUNY-ESF submitted their petition for non-regulated status of Darling 58 American chestnut trees to the U.S. Department of Agriculture (USDA). The Darling 58 trees contain an oxalate oxidase (OxO) gene from wheat that increases blight tolerance. The focus of the USDA petition is to demonstrate that Darling 58 trees pose no increased plant pest risks relative to traditionally bred trees. In 2020, the first public comment period of this petition took place. There will be further regulatory oversight by the Environmental Protection Agency based on the potential of the trees to mitigate the blight fungal infections. Furthermore, the Food and Drug Administration will review any potential for human health impacts from inserting the oxalate oxidase gene. It will likely be at least two more years for these three federal agencies to make their final regulatory decisions on Darling 58 trees.

Outcrossing Darling 58 with a range-wide sample of wild-type American chestnuts is currently the most feasible method to rescue the genetic diversity that remains in the species so that it may resume reproducing and adapting within its native range. Approximately half of the progeny of crosses between wild-type American

chestnut trees and Darling 58 inherit the oxalate oxidase transgene. The inheritance of the transgene can be detected inexpensively using assays conducted on the seeds, which greatly accelerates identification of potentially blight-tolerant individuals. In advance of regulatory decisions and with permits from the USDA, collaborators from TACF, SUNY-ESF, University of New England, and Purdue University pollinated 50 wild-type and American chestnut backcross hybrids with pollen containing the OxO gene. We plan to plant the progeny of these crosses in at least three field locations to test the long-term efficacy of the OxO blight tolerance trait. As these trees flower in 5-10 years, they also have the potential to be sources of larger quantities of seed should Darling 58 trees be deregulated.

Our long-term plan is to breed the descendants of the Darling 58 founder tree with ~700 wild-type and backcross American chestnuts over five generations. Our goal is to represent the genetic diversity remaining in the species so that blight-tolerant American chestnut populations can adapt to a wild geographic range and a changing climate. To ensure that we have enough flowering wild-type American chestnut for this diversification effort, we have increased our efforts in seed collection and graft propagation of wild-type American chestnut trees. In 2020, TACF regional coordinators and volunteers collected scion wood and seed from more than 50 trees. These trees were grafted by collaborators at Purdue, Penn State, and University of Tennessee at Chattanooga (**Figure 3**) and will be planted in germplasm conservation orchards in the spring of 2021. As these trees grow up and flower in the next 5-10 years, we plan to breed them with Darling 58 trees to diversify the blight-tolerant population.



**FIGURE 3:** American chestnuts from Georgia that were grafted and grown under high light treatments to induce pollen production. This is one method to conserve the genetics of American chestnuts that otherwise will not flower under the shade of the forest. (High light germplasm conservation method developed by Trent Deason at University of Tennessee at Chattanooga, picture by Martin Cipollini.)

## COMBINING RESISTANCE TO PRR



*Phytophthora cinnamomi*, a root pathogen which causes Phytophthora root rot (PRR), decimated American chestnut populations in the Southeastern U.S. prior to the introduction of chestnut blight. As winter temperatures warm, the range of *P. cinnamomi* is predicted to expand northward into New England. Thus, incorporating resistance to *P. cinnamomi* is critical in the effort to restore American chestnut. For the past three years TACF has been partnering with the U.S. Forest Service Resistance Screening Center in Asheville, NC to screen American chestnut backcross families for resistance to PRR (Figure 4). The primary goal of this screening is to select backcross trees that inherited most of their genome from American

chestnut while also inheriting high levels of resistance to PRR from their Chinese chestnut ancestors. Once we have identified these PRR-resistant American chestnut backcross hybrids, our intention is to breed them with blight-tolerant Darling 58 transgenic American chestnuts to combine resistance to blight and PRR. In 2020, we inoculated 3,200 seedling progeny derived from open pollination of 105 American chestnut backcross hybrids with American chestnut parentage ranging from Georgia to Maine. We identified 15 PRR-resistant backcross parents whose progeny survived *P. cinnamomi* inoculation at rates of 50% or higher. We planted 180 of the surviving seedlings at a site in Georgia where the soil is infested

with *P. cinnamomi* to screen these seedlings further for resistance in the field. The PRR-resistant backcross parents may be pollinated with Darling 58 pollen as soon as we have permits or federal regulatory approval to do so. The surviving seedlings that we planted this winter are expected to flower in 7-10 years from now. In 2020, we applied Darling 58 pollen to seven backcross trees with resistance PRR to begin the process of combining resistance to the two diseases that decimated American chestnut (Figure 4c).

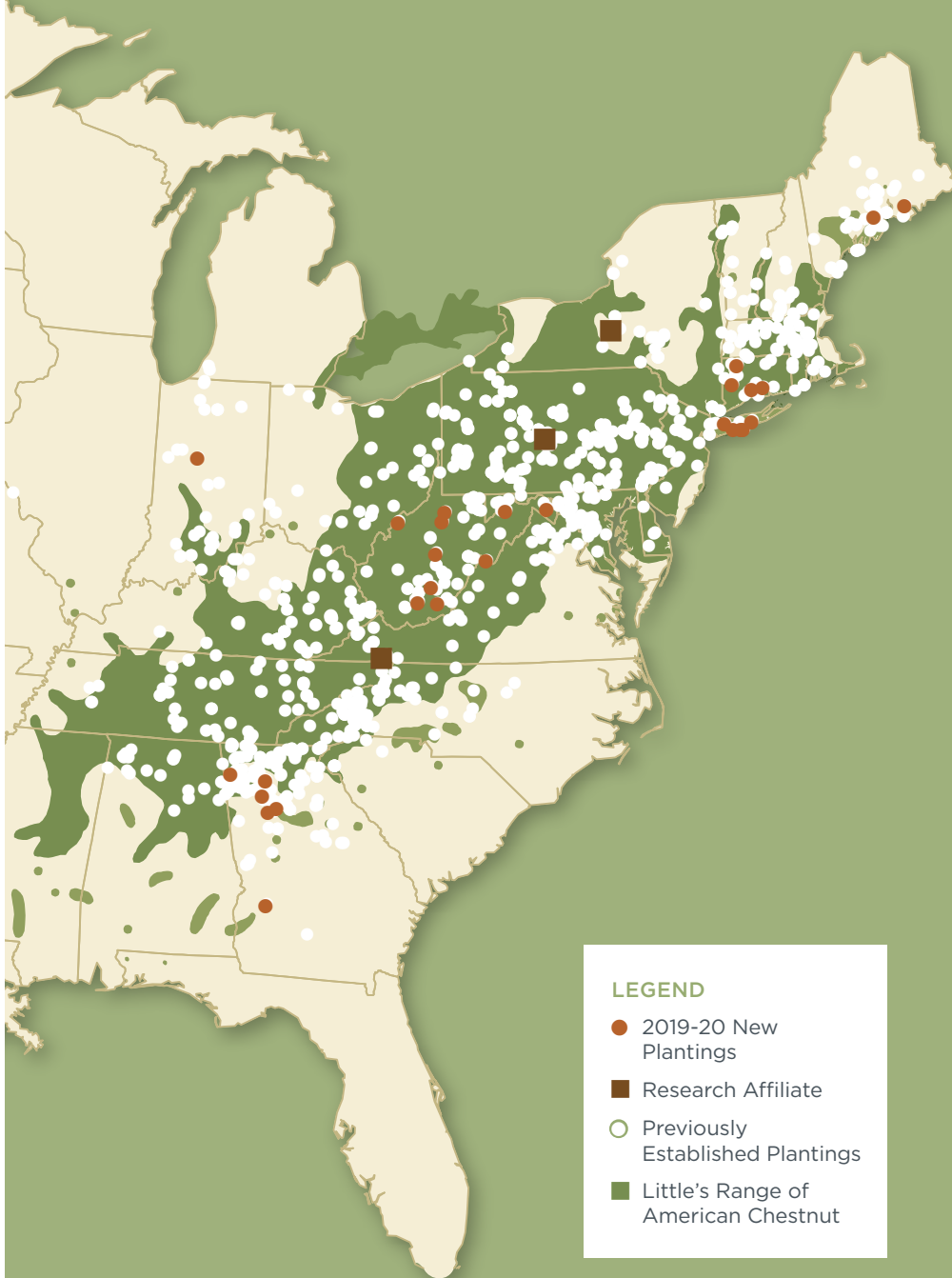
TACF has been inspired by continued enthusiasm for American chestnut restoration in this challenging time. Thank you to our members, volunteers, and donors who keep this bold mission alive.

FIGURE 4: Assessing roots of American chestnut backcross hybrids that are (A) susceptible and (B) resistant to Phytophthora root rot (PRR) caused by the oomycete pathogen *Phytophthora cinnamomi*. (C) In 2020, we applied pollen from Darling 58 blight-tolerant transgenic trees to American chestnut backcross trees that are PRR-resistant to combine resistance to the two pathogens that decimated American chestnut.

## 2019 - 2020 REGIONAL STATS

# Chapter Successes at a Glance

An unprecedented year such as this one brought about unique challenges and, in doing so, introduced opportunities for growth. When stay-at-home measures were implemented in March 2020 because of the coronavirus pandemic, TACF staff and chapter leaders immediately began collaborating on how to stay engaged and plan for inevitable changes to the coming field season.



By the time May arrived and states began to slowly reopen, TACF had developed a set of guidelines for volunteers to follow in order to stay safe during field work. Recommended preparations included a self-health check for symptoms, following any state guidelines on gatherings or travel, ensuring the site owner was comfortable with visitors, and assessing the need. (Non-critical work could be pushed to a later date.) The guidelines also provided direction on social distancing and proper personal protection equipment (PPE) for small group activities. Work that could be done alone or with household members was encouraged.

TACF's Regional Science Coordinators (RSCs) and staff at Meadowview Research Farms made significant changes as well. Field work plans were assessed for safety and feasibility, travel was greatly limited, and essential work was prioritized. Like staff at the national office, RSCs worked mainly from home, except to address critical field data collection and tasks while following state travel guidelines. Meadowview staff stayed home for office work but developed a system for scheduling and limiting the number of people when activities had to be performed on site. Doing this allowed farm staff to carry on with most planned work for the season.

Through extensive, collaborative, and thoughtful planning, field staff and TACF volunteers were able to accomplish much, turning what could have been a lost season into success.



NEW ENGLAND REGION



NORTH CENTRAL REGION



MID-ATLANTIC REGION



SOUTHERN REGION



## OUR DONORS

# Making our Mission Possible

The American Chestnut Foundation deeply appreciates the hard work of its chapter volunteers and committed supporters. Our mission is long-range, and your charitable contributions allow this conservation success story to continue. We are truly grateful for your help in restoring this iconic species.

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Jaye Nydick	John T. Raftis, M.D.	Dr. Philip Smith	Thomas M. Tripp	Robert Woolcock
Michael A. O'Brien	Joshua Parker Ramey	Roy Smith	Troyer Products	Tucker D. Worley
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Roy Orton	Susan Recknagel	Gregory M. Somerville	Robert Van Brunt	
Douglas H. Oswald	Mary Elinor Rees	Southern Conservation District	Elena Sansalone and Jan Van Meter	
Otter Run Fish and Game Club	Chad Retrum	Southern Maine Wetlands Conservancy	David C. Vanaman	
Robert and Elizabeth Owens	Creseda Riccardi	Marci Spencer	Bruce Vanderhoff	
	Robert A. Rice	Ann B. Spires	Vincent C. Vannicola	
		Seth Sprague		

# The Promise of Future Forests

THE WORD LEGACY IS OFTEN USED TO DESCRIBE THE IMPACT OF SOMEONE'S LIFE OR THEIR ACCOMPLISHMENTS. AT THE AMERICAN CHESTNUT FOUNDATION, IT MEANS MORE.

## The Legacy Tree Orchard

program was created to symbolize the permanency and endurance of the research trees nurtured at our Meadowview Research Farms in southwest Virginia for nearly four decades.

The sentiment behind the program is to honor those individuals or families who have a deep abiding commitment to American chestnut restoration and wish to support our mission during, and after, their lifetimes.

Each tree is sponsored by an individual – either in their own name, the name of a company or organization, or in honor/memory of a friend or loved one. A customized plaque placed by the named tree acknowledges the sponsorship. Legacy Tree donors are entitled annually to receive seeds from our latest intermediate blight-resistant crop (number of seeds offered is based on harvest amounts).

All funding received through the Legacy Tree Sponsorship Program is used to support TACF's scientific research to rescue this ecologically significant keystone tree species.





## LEGACY TREE SPONSORS AS OF JUNE 30, 2020

The Family of the Rev. and Mrs. Hugh W. Agricola, Jr., Alabama	The J. Michel Guite Family Foundation, Greenwich, CT	In honor of Fred J. Stanback, Jr.
Allegheny Foundation, Pittsburgh, PA	In honor of Harley and Ringer Families	Donald and Mary Stout Foundation In honor of Timothy Sweeney, Cary, NC
In honor of Gary and Lynn Anderson, loyal, loving, generous hearts - The Mennen Environmental Foundation	In memory of Robert C. Hempel, 1910 - 1989, PA	In honor of John Taft, Sudbury Foundation Trustee, 1973 - 2007, Sudbury, MA
In memory of Virginia Day Baker, Alabama Chapter of TACF	The Hoy Family, Union Mills, NC	In memory of Garold W. Thumm, West Virginia Chapter of TACF
In honor of Glenn Banks	In honor of Edward S. Hutchison	The Tobias Family, New Freedom, PA
In honor of Robert Barenfeld, Planter of Trees	The Janice Michelle Foundation	Rufin Van Bossuyt, Upton, MA
David and Annie Bingham, Salem, CT	In honor of Marshal Case	In loving memory of Belle Bolyard Waddell and Eunice Bolyard Shaver
The Blackmore-Gott Family, Poughkeepsie, NY	Kentucky Chapter of TACF	In memory of W. Duane Waddell West Virginia Chapter of TACF
In memory of Dr. John M. Butler, Mount Pleasant, SC 1924-2006	The Knebel Family, Columbia, SC	WestRock Foundation, Atlanta, GA
In memory of Henry B.R. Brown, Leesburg, VA 1926 - 2008	In honor of Randolph and Grace Knight, Perkinsville, VT	Westwind Foundation, Charlottesville, VA
Sheldon Campbell, Wilson, NC	The LaRoche Family, Ted, Gloria, Ashley, and David, their spouses and children	In honor of Richard Will, given by The Will Group
In Honor of T. Wayne Cary, Anchorage, AK	Lewis and Kate Lobdell in honor of Kale Partners and The Chestnut Ridge, Pennsylvania Partners in Conservation	Richard and Carol Will, Georgetown, TX
In memory of Roger R. Cholin	In memory of Charles Parkhill Lykes, 3/4/1917 - 5/25/1989	Richard Will in honor of: TACF Volunteers Dr. Norman Borlaug Marshal Case Dr. Al Ellingboe Dr. Fred Hebard Dr. William MacDonald Rex Mann Phil Rutter Dr. Paul H. Sisco, Jr. Brad Stanback and Shelli Lodge-Stanback James Ulring Daphne Van Schaick Donald C. Willeke, Esq.
In memory of George Grover Cole, 2016, Virginia Chapter of TACF	In memory of Dr. William G. Lord, Pittsburgh, PA	In Memory of Arthur Williams, 1872 - 1961, Great Bend, PA
In memory of Jerry S. Conking, Canadaigua, NY	In honor of Maine Chapter of TACF	In Memory of Norman H. Williams, 1913 - 2000, New Milford, PA
Connecticut Chapter of TACF	In honor of the Myers family of Mercersburg, PA and the Smith family of Beaver Falls, PA	Alan and Marilyn Youel, Richfield, MN
In honor of Lewis L. Cramer	In honor of William D. Nelson, MN	Stephen and Suzan Zoukis in honor of Cashiers Village
In honor of Dr. Thomas Gray Curtis, Jr., Cataumet, MA	The Owens Family, Boston, MA	
In honor of Dr. Albert Dietz	Alan and Yvonne Palmer, Wilmington, DE	
In Memory of Lawrence Dimmitt IV, 9/29/1984 - 8/24/2017	Debby Pearsall, Mt. Bethel, PA	
Michael and Linda Doochin and Family	In Memory of Auden Orion Rafert, Forever in our Hearts	
Robert H. Dunlap, Batesville, MS	Dr. Gary Roop Family, New Windsor, MD	
The Evangelakos Family, New York, NY	In honor of Emily Rutherford's children and grandchildren of the Rutherford, Smykal, and Cookerly families	
Georgia Chapter of TACF	In memory of Edwin Smoots, Burnsville, MN	
In honor of George Gibbs, Louisville, KY		

## THE AMERICAN CHESTNUT FOUNDATION

# Financials

### PUBLIC SUPPORT AND OTHER REVENUES

		<u>% of Income</u>
Contributions	\$1,962,993	71.9%
Membership	436,631	16.0%
Federal Grants	75,388	2.8%
Investment Income	124,665	4.5%
Merchandise Sales	21,678	0.8%
All Other Income	110,414	4.0%
<b>TOTAL REVENUE</b>	<b>\$2,731,769</b>	

### EXPENSES

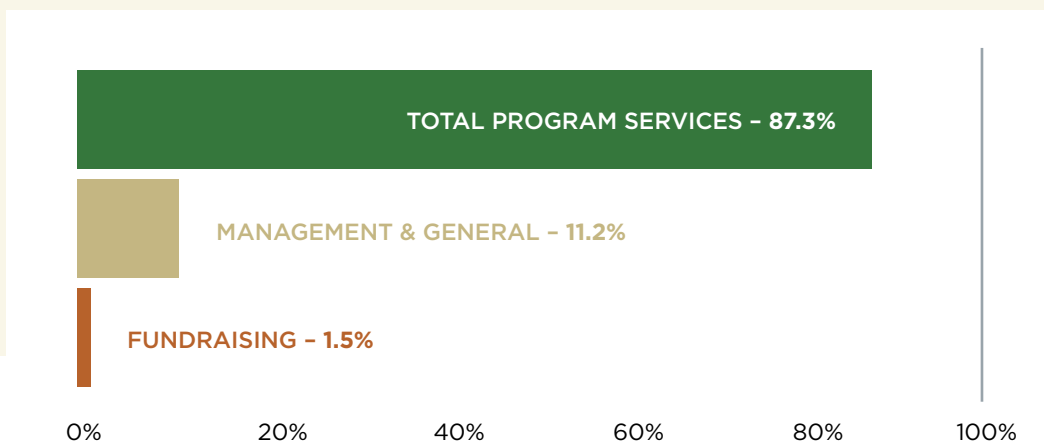
#### PROGRAM SERVICES

		<u>% of Expense</u>
External Research	\$337,166	12.6%
National Office Operations	415,330	15.5%
Marketing & Communications	165,370	6.2%
Science & Research	743,828	27.8%
Chapter & Membership	237,416	8.9%
Research Farm Operations	435,733	16.3%
<b>TOTAL PROGRAM SERVICES</b>	<b>\$2,334,843</b>	<b>87.3%</b>

#### SUPPORTING SERVICES

Management & General	\$298,245	11.2%
Fundraising	39,249	1.5%
<b>TOTAL SUPPORTING SERVICES</b>	<b>\$337,494</b>	<b>12.7%</b>

<b>TOTAL EXPENSES</b>	<b>\$2,672,337</b>
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TACF is extremely proud  
of its 2019

**4-Star Rating**

from Charity Navigator  
for seven straight years.

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University Park, PA 16802  
(814) 863-7192

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