TREE FUND
Cultivating Innovation

Itinerary
Trustee/Liaison Meetings
Sunday, December 4 - Monday, December 5, 2016
Embassy Suites, 5500 N. River Rd., Rosemont, IL
847-678-4000

Embassy Suites offers complimentary shuttle service to/from O'Hare Airport. The hotel is located 1.5 miles from O'Hare. The shuttle ride takes 10-20 minutes depending on traffic. At O'Hare, look for signs for the Bus Shuttle Center (they're posted in the same areas as signs for Baggage Claim). The shuttle picks up at Door #3 at the Bus Shuttle Center which is right across the street from the Hilton O'Hare Airport. You will look for a large white van/bus with Embassy Suites, DoubleTree, and Hilton logos on it. The shuttle runs 24 hours, and continuously from 4am-midnight. If you arrive between midnight and 4am it is best to call the front desk (847-678-4000) and they will send out a driver. For your return to O'Hare, the shuttle leaves from the Embassy Suites every 20 minutes on the hour.

Sunday, December 4th	Trustee/Liaison Social Reception	
5:30pm – 6:30pm	Embassy Suites Atrium	
6:30pm	Trustee/Liaison Dinner Basil's Kitchen, Embassy Suites	

Complimentary breakfast served to hotel guests in the Atrium beginning at 6:00am

Monday, December 5th		
7:30am – 8:00am	Joint Trustee/Liaison Meeting Salon A&B	
8:00am – 12:30pm	Liaison Meeting Salon A&B	Trustee Meeting Salon E
12:30 noon – 1:30pm	Trustee/Liaison Lunch Basil's Kitchen	
1:30pm – 4:00pm	Liaison Meeting Salon A&B	Trustee Meeting Salon E
4:00pm – 5:00pm	Joint Trustee/Liaison Meeting Salon A&B	
5:00pm	Adjourn	

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Trustee Meeting Agenda
Monday, December 5, 2016
Embassy Suites, 5500 N. River Rd., Rosemont, IL

7:30	Joint Session with Liaisons – Salon AB	
8:00	Call to Order and Consent Agenda – Salon E	Miller
	• Celebrations	
	• Consent Agenda	
	o Minutes from 10/3/16 Trustee Meeting	Tab 1
	o President and CEO's Report	Tab 2
	o Treasurer's Report Including October Financials	Tab 3a-c
	o Development and Communications Committee Report	Tab 4
	o Research & Education Committee Report	Tab 5
	o Governance Committee Report	Tab 6
	o Liaison Committee Report	Tab 7
	o Audit Committee Report	Tab 8
8:15	CCS Presentation in Executive Session	Manno Azuma
9:45	Trustee Vote on CCS Report in Executive Session	
10:00	Break	
10:15	Proposed 2017 Budget Presentation and Vote	Henning
	• Proposed 2017 Budget Summary	Tab 9a
	• Campaign Cash Flow 2017-2023	Tab 9b
11:15	Trust Agreement Presentation and Votes	Geist
	• Restated Declaration of Trust	Tab 10a
	• Attachments	Tab 10b
	o Trustee Terms	
	o Trustee Reimbursement	
	o Funds Held in Perpetuity	
	o All Other Administrative Revisions	
11:45	Research Committee Recommendations	Dozier
	• Recommendations and Vote on Duling & Kimmel Grants	Tab 11a-e
	• Vote on PG&E/UAA Sponsored IVM Pilot Program	Tab 12
	• How to Expend Grant Portfolio	
	o Adult Education (Non-K-12)?	
	o Social Science Benefits of Urban Forestry?	
12:30	Lunch at Basil's	

1:30 Chairs Summarize Committee Highlights Not Covered in Morning Agenda Items (October to December 2016)

- Ray Henning, Finance Committee
- Steve Geist, Governance Committee
- Hallie Dozier, Research and Education Committee
- Brian Sayers, Development and Communications Committee
- Beau Brodbeck, Liaison Committee
- Will Nutter, Audit Committee
- Al West, Council of Representatives
- J. Eric Smith, President and CEO

2:15 Election of Officers, Trustees, Confirm Committee Chair Appointments — Geist

- Vote on New Trustee - Sharon Lilly (two year term)
- Vote on Renewal Term - Paul Fletcher (two year term)
- Vote on Slate of Officers (one year terms):
  - Chairman – Brian Sayers
  - Chair Elect – Steve Geist
  - Vice Chair – Tom Wolf
  - Treasurer – Ray Henning
- Confirm Committee Chair Appointments (one year terms):
  - Research and Education
  - Governance
  - Development and Communications
  - Finance
  - Audit

2:30 Break

2:45 New Business

- Recognize Outgoing Trustees Randall Miller, Hallie Dozier

3:00 Old Business

3:15 Housekeeping

- Conflict of Interest Form Returns
- 2017 Meeting Schedule
  - Monday, May 1 or May 8
  - Monday, October 9 webinar
  - Sunday and Monday, December 10 and 11
    - Different location? Separate from Liaison Meeting?

3:30 Executive Session

4:00 Joint Session with Liaisons – Salon AB

- Summarize Trustee Meeting
- Summarize Liaison Meeting
- Goals and Priorities for 2017

5:00 Adjourn

Trustee Meeting Minutes

Date and time of meeting: October 3, 2016, 2016, 1:00pm Central Time via conference call
Attending: Randall Miller, Chairman; Brian Sayers, Chair Elect; Steven Geist, Vice Chairman; Ray Henning, Treasurer. Trustees: Brent Asplundh, Jim Barborinas, Beau Brodbeck, Hallie Dozier, George Hudler, Will Nutter, Roger Phelps (left meeting at 1:55pm), Bill Schleizer, Jim Urban, Jeff Wilson, Tom Wolf. Chairman Emeritus Al West. President and Chief Executive Officer: J. Eric Smith.
Absent: Trustees: Paul Fletcher

Meeting call to order: Chairman Miller called the meeting to order at 1:04pm.

Consent Agenda: Motion was made by Trustee Asplundh to approve the Consent Agenda. Motion was seconded by Trustee Barborinas. Discussion: None. Motion carried. Consent Agenda items included:

- Minutes from May 16, 2016 Trustee Meeting
- Treasurer's Report, including August 2016 Operating Profit and Loss Report and July 2016 CCT Investment Report
- President and CEO Report
- Governance Committee Report
- Development and Communications Committee Report
- Liaison Committee Report
- Audit Committee Report
- Council of Representatives Report

Chair Summaries of Committee Highlights (May to October 2016):

- **Ray Henning, Finance Committee:** Committee is meeting monthly vs. quarterly. Insurance policies were reviewed and umbrella coverage was added to both Tour and TREE Fund general operating policies.
- **Steve Geist, Governance Committee:** Trust Agreement was reviewed by Committee and will be going to legal counsel for review before Committee makes recommendations to Trustees for revisions in advance of December Board Meetings. Trustee Geist announced that Trustee Wolf has agreed to serve as Vice Chair of the Board in 2017. Chairman Emeritus Al West suggested contacting ISA to ensure no concerns there, since Trustee Wolf is also on ISA's board.
- **Dr. Hallie Dozier, Research and Education Committee:** Research Committee met by phone to made recommendations for Research Fellowship awardee and Ohio Chapter ISA Education Grant awardee. Transitioning with George Hudler to take over as Committee Chair.
- **Dr. Brian Sayers, Development and Communications Committee:** CCS is conducting interviews with trustees and will be contacting constituents shortly. President Smith will get weekly updates from them. CCS will attend Development and Communications Committee call on October 18 and Executive Committee call in November with interim report. They will make a presentation to the board on December 5. Development and Communications Chair position will be open in 2017; encourage volunteers.
- **Beau Brodbeck, Liaison Committee:** Midwestern Chapter Liaison has stepped down. Committee is shifting to "friendraising" model. Chapter Challenge program has been suspended;

Chapters will be treated as Corporate Partners and receive recognition throughout the year per normal partner policies. Liaison terms limits will be discussed at December 5 meeting. Committee meetings will be held bi-monthly. President Smith noted professional PR support may be required to enable better dissemination of knowledge gained from research, but that this initiative has been pushed into 2017 to make funds available for the CCS Feasibility Study this year.

- **Will Nutter, Audit Committee:** Committee reviewed proposals from five auditors, and interviewed three, including current auditor. Sassetti LLC aligns was selected as best candidate on both price and quality of interview and proposal. If board approves, Chairman Nutter will execute engagement letter. Finance Committee will appoint a liaison to Audit Committee.
- **Al West, Council of Representatives:** Trustee West represents TREE Fund as a non-voting member of council. Trustee Wolf stood in for Trustee West at COR meeting at ISA Conference in Fort Worth, Texas. ISA is currently reviewing their bylaws.
- **J. Eric Smith, President and CEO:** Laura Flamion has been selected as new Bookkeeper/Administrative Associate. She will be in the office 24 hours per week in an independent contractor relationship. Services from Scott & McCoy have been concluded. PG&E Challenge raised $250,000; they will be invoiced for $125,000 match this week. President Smith will attend ISA Leadership Workshop this month and present focus on international chapters, research abroad and engagement of international liaisons.

Research and Education Grant Award Votes:

Motion was made by Trustee Barborinas to ratify electronic votes for Horace M. Thayer Scholarship of $2,000 to Thomas McNulty, Frank Ward Scholarship of $2,000 to Allison Wilson and John Wright Memorial Scholarship of $2,000 to Conor Smith. Motion was second by Trustee Henning. Motion carried.

Committee recommends Research Fellowship award of $99,931 to Dr. Mitchell Pavao-Zuckerman for his project "Innovative Practices to Enhance Soil Quality for Vacant Urban Lot Afforestation." Trustee Henning made a motion to approve award; Trustee Schleizer seconded. Motion carried.

Committee recommended funding of $5,000 to The Holden Arboretum for their Ohio Chapter ISA Education Grant program "Forest Immersion XP (FIXP)." Motion was made by Trustee Geist to approve award; seconded by Trustee Barborinas. Motion carried.

Old Business:

- **Trustee and Committee Member Recruitment**: Governance Chair Geist stated the need for a pool of trustees for Executive Committee and Committee Chairs.
- **Upcoming Grants and Scholarships:** Duling and Kimmel applications closed October 1. Plan to award three Duling Grants and two Kimmel Grants, if Canadian TREE Fund agrees, at the December 5 board meeting. UAA has transferred $240,000 for current year UARF work, and RFP has been issued for a directed/sponsored grant with two researchers from Sonoma State University. Their proposal will be submitted in October. Board approval will be required to issue grant. We are on target to reach goal of awarding $450,000 in grants in 2016, per budget.
- **Feasibility Study:** As reported by Trustee Sayers above.

- **Review Additional Investment Vehicles:** Our newly engaged auditor will review bookkeeping on endowment to ensure it properly reflects our relationship with Chicago Community Trust. New investment vehicle(s) will be evaluated for placement of new funds. President Smith is in process of reviewing several options.
- **Office Lease and Staffing:** Phase II of office renovation has been completed. We have a five-year lease that doubles our space for about 50% more per month in rent.
- **December 2016 Meeting Schedule:** Sunday evening reception and dinner. Monday begins and ends with joint trustee/liaison meetings. Liaison and Trustee meetings will be held mid-day. Agenda will be developed with Executive Committee; framework of agenda to be distributed early November. CCT will report to Finance Committee on endowment in November so that Treasurer Henning is able to report to the board at December trustee meeting.

New Business:

- Motion was made by Trustee Henning to approve Engagement Letter from Sassetti LLC; motion was seconded by Trustee Geist. Discussion: Audit Committee recommends this change in auditor for three year engagement with two option years. Motion carried.
- Trust Agreement Review: As stated earlier by Governance Chair Geist; President Smith will send copies of latest annotated version to Trustee West and Governance Committee.

At 2:35pm, staff were excused and the Board went into Executive Session. Executive Session ended at 2:45pm and the meeting adjourned immediately thereafter.

Task		Assigned to		Due
Notify ISA of Tom Wolf's appointment as TREE Fund Vice Chair		Miller/Geist		12/5/16
Encourage volunteer for Development and Communications Committee Chair		Trustees		12/5/16
Finance Committee appoint Liaison to Audit Committee		Henning		12/5/16
Send copies of Trust Agreement revisions to Al West and Governance Committee		Smith		10/20/16

Respectfully submitted by Barbara Duke.

TREE FUND MEMORANDUM

Date: November 22, 2016

To: TREE Fund Board of Trustees

Fm: J. Eric Smith, President and Chief Executive Officer

Re: Report for December 5, 2016 Trustee Meeting

INTRODUCTION:

Last Friday, I returned to our Naperville office after a productive experience participating in the Partners for Community Forestry's (PCF) 10th Annual Conference. I was grateful that the Arbor Day Foundation (who organized the event) gave me a prominent moderating position at the closing general session at this high-value conference, which attracted over 550 people through its two-day schedule, many of whom are new to me and the TREE Fund – and many of whom are decision-makers and policy-shapers who could best benefit from (and support) our research, community engagement and education programs.

This was the final trip of my 2016 "listening tour," and it was easily among the best networking and "friendraising" events of the year for me. I think it's important to note that this is a conference that TREE Fund staff and management have not attended in the past – in large part because it does not lend itself to small-value retail fundraising. As we seek to "open the circle" of funders in years ahead, though, this event is *exactly* the type of setting where we will make the new connections needed to cultivate new partners, and I see PCF as an anchor of my travel schedule for the foreseeable future accordingly.

Having visited 18 of the 20 U.S. ISA Chapters this year (Rocky Mountain and Michigan are the only two I could not schedule; I have Michigan calendared in early 2017 already, and am working to get to Rocky Mountain in the first half of the year, too), I feel that I have been able to communicate a fresh message and demonstrate the importance that *all* of our ISA colleagues hold for us, and not just those belonging to large and affluent chapters. While I cannot (and should not) attempt to visit all 20 U.S. Chapters on an annual basis, I have set a goal for 2017 and beyond to have staff representation (me or others) at least every other year at every U.S. Chapter, while better empowering our liaisons to be our "champions" in the years when we are not there.

My travel activities in 2017 will focus more on completing the quiet phase of our endowment building campaign (including "seating" the campaign leadership committee), and on identifying and participating in high-impact, high-connection events like PCF. There are likely to be cases where I will be visiting some of your own geographic regions, and in many of those cases, it will advantageous to our campaign outcomes for me to be joined by Trustee(s) as I make cultivation and solicitation visits – so I will be in touch with respectful requests as needed in the months ahead, and am hopeful you will be able to make time to support such activities.

As I've noted to you all before, I believe in frank and full reporting in my communications with you, as I believe you require such candid information to properly fulfill your own fiduciary and governance responsibilities to our corporation. By necessity, such candor also dictates that documents like this one be held closely by their intended recipients, and considered company sensitive information. Therefore, I respectfully request that you do not forward or share this report beyond Trustees, Barb Duke and I, with thanks in advance for your discretion.

KEY PROJECTS COMPLETED IN 2016:

Much of my activity since our October teleconference has been focused on key items that will be carried to the Trustees for action on December 5 via your committee chairs or as part of our report from CCS on the Endowment Building Campaign Feasibility Study, so rather than just reiterating points that will be made in those Committee Reports, I want to provide a very macro summary of some key projects and activities that the team and I have completed this year to provide a sense of how we have moved some strategic elements forward atop our normal tactical operations:

- Created more timely and concise financial reports and implemented monthly Finance Committee meetings to provide more "real time" coverage of our activities.
- Completed Audit Committee RFP and engaged new auditor on three-year contract.
- Completed Feasibility Study RFP and will receive CCS's report on December 5.
- Negotiated a new five-year office lease, doubling our space with only a 50% increase in cost.
- Negotiated a new three-year contract with our STIHL Tour des Trees Tour Manager, more clearly defining staff vs contractor roles to enhance efficiency and accountability.
- Evaluated all insurance policies and made changes to provide enhanced risk management.
- Conducted banking reviews and shifted operating accounts to new provider with better service structure and lower fees.
- Completed full legal and policy review of the Trust Agreement that defines our governance structure and will present restated version for Trustee approval on December 5.
- Clarified the nature of the relationship between Chicago Community Trust (CCT) and TREE Fund, collecting required documentation and recommending Board action to ensure these funds are properly posted in our general ledger and balance sheet.
- Implemented and completed year one of the PG&E challenge, and issued new RFP for pilot program to establish test sites in California for future utility grants; Dr. Dozier will have a recommendation for Trustee action on the $175,000 pilot grant on December 5.
- Created new Corporate Partnership models that are fully compliant with relevant tax and reporting regulations to ensure proper allocation of charitable contributions vs earned income.
- Reinvented "TREE Fund After Hours" event successfully at the ISA International Conference, beating both revenue and expense goals.
- Completed 2016 STIHL Tour des Trees under new fundraising and community engagement rubric that directs all rider funds to research, allows donors to restrict Tour donations to endowment, and seeks to defray all expenses with corporate partners; all goals achieved, and we are on track for a record-setting $400,000 rider fundraising response by year's end.

- Implemented aggressive efforts to increase grant application and award levels; we should exceed the ambitious $450,000 award goal in 2016, with at least $350,000 per year to be included in the 2017 budget (this number is contingent on CCS's report) and beyond.
- Managed these activities while declining to accept any payments from Chicago Community Trust this year to demonstrate our ability to live within our means, and draw down surplus operating reserves; the funds we did not take in 2016 will be available to us in 2017 to fund campaign and related expenses.
- Made real time transfers to CCT of endowment gifts throughout the year, rather than mingling funds with operations and doing a single transfer at year end; as a result, the endowment will grow by nearly 25% in 2017.

CAMPAIGN FEASIBILITY STUDY AND 2017 BUDGET

We have a tight series of interconnected activities going on this month to bring both the CCS Feasibility Study report and the 2017 budget to you for action. I provided the detailed 2017 Budget Proposal to Finance Committee on November 4, and we discussed it as a committee on November 18. This budget assumes that the Endowment Building Campaign will be at the $5.0 million level we are testing in the Feasibility Study. Finance Committee has a follow-up meeting scheduled on November 29 for their final approval of budget levels to be carried to you for approval. CCS's written report of the Feasibility Study findings is due to us on November 30, so I have requested that if CCS anticipates recommending a level below the $5.0 million goal we are testing, then they let me know that before the November 29 Finance Committee meeting, so that I can adjust the budget figures appropriately. Once the Finance Committee has approved these revised and final budget numbers, I will provide all of the Trustees with the summary budget and the campaign cash flow analysis, and these will be the documents we will review on December 5. On these fronts, I will be seeking two votes from the Trustees at the December 5 meeting: one to affirm the CCS findings, then one to approve the related budget level for 2017.

2016 FINANCIALS

Bottom line: we've had a great year. Through the end of October, here's how things look:

	Annual Budget	YTD Thru October	Year End Forecast
Revenue	$1,167,500	$1,459,351	$1,668,000
Expense	$1,223,900	$ 901,397	$1,369,000
Net Income	($56,400)	$ 243,954	$ 299,000

Our total transfers to endowment should be about $570,000 for the year, so our net assets increase significantly, but our cash liquidity will decrease. This is consistent with my budget plan for the year; we had surplus contingency cash reserves in our operating account at the start of the year, and our heightened real-time increased reporting to Finance Committee and monitoring of accounts is allowing us to manage "closer to the bone" than we have in the past.

Revenue lines are up largely because of our success with the PG&E Challenge, the UAA/PG&E Current Year Pilot Project award that came in higher than I had budgeted, gifts to the Collier Fund made at last year's Winter Management Conference, and higher-than-budgeted returns for rider fundraising on the Tour (we should hit $400,000 this year) and the new TREE Fund After Hours Event. Expenses are in line with budget except in two areas: we are spending more on subcontracted operations (primarily the CCS contract, along with some other consultant labor on the accounting side), and we will book about $550,000 for grants awarded instead of $450,000 budgeted due to the accrual nature of our accounting practices, and the ways in which the UAA/PG&E Current Year Pilot Project funding is coming in and going out. (Dr. Dozier will be recommending a vote on a $175,000 award for this sponsored grant at the December 5 meeting; it will not be paid until 2017 and 2018, but must be booked as an account payable upon completion of its contract in December). We will adjust the 2017 grant award number from $450,000 to $350,000 to reflect this timing shift.

In terms of year-end closeout, staff and I will have our kick-off meeting with our new auditors, Sassetti LLC, on December 7, and they have already scheduled their first call with the Audit Committee in January. We have contracted with Laura Flamion of Clear Impact Financial LLC to serve as our independent book-keeper through the end of 2017, with options to continue her service beyond that, so I am pleased that we have stabilized our accounting function with strong, fresh perspective as we move forward into the campaign.

GOVERNANCE

I have been working with Governance Committee to review and update our Trust Agreement to reflect current realities (legal and organizational), as well as organizational aspirations. The document has been "edited by accretion" since our organization in 2002, with occasional edits to change committee names, number of trustees, titles of officers, etc. But it contains some language that is inconsistent with current nonprofit practice and our own policies, and it defines terms and commitments that are making it more difficult than it should be to recruit new Trustees. The Governance Committee completed a comprehensive review of the document with recommendations for updates, and I subsequently provided the amended documents to an attorney recommended to us by ISA for legal and regulatory review.

As a result of this process, we have prepared a Restated Declaration of Trust which will be presented to the Trustees for approval and ratification. Four separate motions will be requested on this document, as follows:

- Revisions to term limits (Trustee terms shift from two three-year terms to three two-year terms; officer terms shift from two years to one year);
- Allowance for funds to be restricted in perpetuity (Original language limited donor restrictions to 15 years, undercutting arguments that we are an endowment fund);
- Clarification of reimbursement for Trustees (Original language allowed Trustees to be compensated; new language allows reimbursement of expenses not covered by employers, but no compensation);
- Other administrative changes (A "catch-all" for other administrative changes designed to reflect current nonprofit law and policy; none have material impact on operations).

Assuming approval of this Restated Declaration of Trust, I will support Governance Committee in 2017 in conducting a thorough review of our policies to ensure they too reflect the current declaration and best nonprofit practice.

RESEARCH AND EDUCATION

Based on our success with the Raise Your Hand for Research auction at TREE Fund After Hours, and the budget-beating performance of our riders in the 2016 Tour, I notified the Research and Education Committee that we will be able to award three Duling grants and two Kimmel grants at our December 5 meeting, presuming the Committee had sufficient high-quality applications to support those levels. (Canadian TREE Fund will pay for one of the Kimmels, and we will pay for the other). As noted above, we will also have a recommendation to award $175,000 for a PG&E/UAA-Sponsored grant to establish long-term test plots in California for integrated vegetation management research under the UARF umbrella. As refresher/reminder, such sponsored grants are not competitive, and we collect a "management fee" for handling them; in this case, we will apply that fee to the UARF endowment so that we may receive the 50% matching gift from PG&E in 2017. Also as noted above, from an accounting standpoint, we will need to book this grant in 2016, even though the funds will not be paid until 2017 and 2018. Our final report of grants awarded in 2016 will be ~$550,000 accordingly, a record-setting performance that positions us well as we move into the endowment building campaign. 2017's research budget will be adjusted from $450,000 to $350,000 to reflect the cash flows associated with the PG&E/UAA-sponsored grant and our two open Research Fellowships, both of which will have payments due in 2017.

FUTURE MEETINGS

I have asked the Liaison Committee, and would respectfully ask the Trustees as well, to consider how we manage our meetings of these groups. While there are positive elements associated with bringing Trustees and Liaisons together each December for a shared meeting, the downside of this approach is that the Liaison Chair is not able to fully participate in the Board's deliberations, and I am not able to fully participate in the Liaison Committee's deliberations. As we are seeking to adapt the roles of the liaisons from retail fundraising to "friendraising," I think these overlaps may be undermining effective communication. I would respectfully like to consider (or return to) a model where the liaisons meet independently of the Trustees, possibly moving to different chapters each year. I would also ask the Trustees to consider whether the December meeting in Rosemont is optimal each year; to me, it seems to prioritize staff convenience over all other considerations, and I do not believe that should be our top priority. Would we want to gather elsewhere at that time? Perhaps at sites that are supported by our grants, etc., as we do in the spring at Morton Arboretum? I would welcome the opportunity to discuss these matters with Executive and Liaison Committees in 2017.

CONCLUSION

2016 has been an exciting year, and I think we are poised for 2017 to be truly transformational. We should have a clear road-map from CCS on necessary steps in the early part of the year to establish our campaign leadership committee and hopefully complete the quiet phase of the

campaign in an expeditious fashion. As noted in my prior report, I may need to make changes to our human resources pool to achieve these goals, with a combination of staff and consultant positions being budgeted in my 2017 proposal. I will not know exactly what this mix looks like until we receive CCS's report, but I have built in the flexibility necessary to allow me to manage the campaign under all likely outcomes. I will keep you posted as we move forward.

Please don't hesitate to let me know if you have any questions, comments, or concerns with anything contained in this report. I remain excited about my work, happy to represent our organization around the country, and pleased with the leadership and wise counsel you have provided to me.

All best,

J. Eric Smith,
President and Chief Executive Officer

Finance Committee Report
Prepared by: Ray Henning, Chair
Date Submitted: November 18, 2016

The Finance Committee is charged with the following:

Basic Function: Responsible for the overall direction and control of the finances of the organization.

Responsibilities:

- Coordinates the preparation of the annual budget
- Makes recommendation of annual budget to the board
- Reviews monthly financial reports
- Compares actual expenses to approved budgeted expenses and discuss variances, make recommendations as necessary
- Reviews budgets of special projects and makes recommendations to the board
- Reviews on an annual basis the sources of funding for the organization
- Recommends to the board the investment of funds and reports to the board on a regular basis the condition of such investments
- Reviews annually amount of insurance coverage
- Reviews credit card procedures annually
- Reports to the board other financial matters deemed appropriate by the board

Related Strategic Initiatives:

Goals:

- To provide overall direction and oversight of the finances of the TREE Fund
- To understand the oversight process in order to insure the integrity of our resources
- Fiscally responsible Board of Trustees

Outcomes:

- A financial plan which is supportive of our strategic plan
- Availability of sufficient liquid cash to support operations
- Financial reports which are accurate, comprehensive and informative
- Deposits equal to 30% of annual estimated operating budget in a reserve account

Objective	Who	What	By When	Resources needed
Prepare a 3-year financial forecast				
Identify a mechanism for building the reserve account.		$180K	12/31/17	
Budget approved annually	Staff Committee Chair	Develop annual budget to support strategic initiatives	Annual meeting in December	trustee time executive staff time, bookkeeper time, committees' budgets, conference call $
Financial recommendations at each board meeting	Treasurer	Present treasurer report at each board meeting and make recommendations for approval or revision as needed.	May August Dec. 30	trustee time, staff time,
Monitor CCT performance compliance w/policy	Full committee		May	investment policy, endowment policy Trustee Time
Report on Named Funds	President CEO	Purpose; Financial Goal; date for initial disbursement	May Board meeting	Balance Sheet Fund establishment documents Executive time Staff time

Meetings:

Date: October 31, 2016

Participants: Ray Henning, Rick Joyce, Terry McGonegle; J. Eric Smith; Tom Wolf; Laura Flamion.

Topics and actions: Reviewed the August CCT Statement and the September, 2016 financial statements. Mr. McGonegle volunteered to act as liaison between Finance and Audit Committees. Bookkeeper, Laura Flamion was introduced to the Committee. A high level overview of 2017 proposed budget was presented.

Date: November 18, 2016

Participants: Ray Henning, Terry McGonegle; J. Eric Smith; Tom Wolf; Laura Flamion.

Topics and actions: Reviewed the September CCT Statement and the October, 2016 financial statements. YTD revenue through October 2016 is nearly double YTD revenue through October 2015 due to growth from PG&E Challenge, STIHL Tour des Trees and TREE Fund After Hours. Our expenses remain lower than budget and total assets have exceeded $4.0 million. The 2017 proposed budget was reviewed in detail.

Accomplishments:

What has your committee done this year to support the strategic plan? The Finance Committee has provided overall direction and oversight of the finances of the TREE Fund to insure the integrity of our resources. We have provided a financial plan which is supportive of our strategic plan; ensured the availability of sufficient liquid cash to support operations; prepared financial reports which are accurate, comprehensive and informative and maintained a reserve equal to 30% of annual estimated operating budget. In addition the Finance Committee has: requested monthly financial statements, increased our meeting frequency to monthly, reviewed and approved the proposed Endowment Campaign, requested that funds be sent to CCT on a monthly basis, review the Corporate and Tour insurance policies and increased umbrella coverages**,** and reviewed the proposed 2017 operating budget.

Objectives for the next 3 months: Maintain the financial integrity of the TREE Fund by monitoring the monthly financial statements.

Next Meeting Date: November 29, 2016 to approve the proposed budget and receive an update from CCT on the endowment.

TREE FUND
Cultivating Innovation

Finance Committee Meeting Minutes

Date & time of meeting: November 18 2016, 10am Central Time via conference call

Attending: Ray Henning, Treasurer; Terry McGonegle; J. Eric Smith; Tom Wolf; Laura Flamion

Excused: Rick Joyce, Bill Schleizer

Call to Order: Treasurer Henning called the meeting to order at 10:02am Central Time.

Confirm Minutes from October 31, 2016 meeting: Mr. Wolf noted a correction on the minutes in "September 2016 Financial Statements: Exceeded revenue in 3Q budget. Expect $125K from **PG&G** in November." PG&G will be revised to PG&E. Mr. Wolf made a motion to approve the minutes as corrected; Mr. McGonegle seconded. Motion carried.

October 2016 Financial Statements: YTD revenue through October 2016 is nearly double YTD revenue through October 2015 due to growth from PG&E Challenge, STIHL Tour des Trees and TREE Fund After Hours. Waiting for $125K from PG&E and for the application for the 2016 directed grant to be paid from $240K received from UAA in September. Phase I expected to be $175K. Research Chair will review application and make recommendation for approval to Board at either December 5 meeting or via electronic vote afterward. Annual appeal letters will be going out shortly. Revenue from 2015 annual appeal was ~$30,000.

September CCT Summary and Detail Reports: $240,000 temporarily restricted assets are for UARF grant. Transferred $100,994 to CCT as permanently restricted at end of October, not yet appearing on CCT statement.

Executive Session began at 10:25am

Old Business and New Business: none

Meeting adjourned at 11:45am Central Time. Next meeting is scheduled November 29 at 1:00pm Central Time via conference call to review and vote to approve proposed 2017 budget. J. Eric Smith will contact Rick Joyce and Bill Schleizer to review proposed budget prior to November 29.

Task		Assigned to		Due date
Amend October 31 minutes		Barb Duke		11/18/16
Review 2017 proposed budget with Rick Joyce and Bill Schleizer		J. Eric Smith		11/28/16

TREE FUND
Cultivating Innovation

Finance Committee Meeting Minutes

Date & time of meeting: October 31, 2016, 11am Central Time via conference call

Attending: Ray Henning, Treasurer; Rick Joyce, Terry McGonegle; J. Eric Smith; Tom Wolf; Laura Flamion

Excused: Bill Schleizer

Call To Order: Treasurer Henning called the meeting to order at 11:03am Central Time.

Confirm Minutes from September 20, 2016 meeting: Mr. McGonegle made a motion to approve the minutes; Mr. Wolf seconded. Motion carried.

September 2016 Financial Statements: Exceeded revenue in 3Q budget. Expect $125K from PG&E in November. Reviewed Year End Spreadsheet which will also be forwarded to Committee in November and December. Balance Sheet will be amended effective with October financials to show Temporarily Restricted Equity as Permanently Restricted.

August CCT Summary and Detail Reports: Detail spreadsheet reflects pro-rated funds as part of CCT pool. Spending Allocation continues to roll over.

Old Business: President Smith gave a high level overview of 2017 proposed budget in advance of providing it to Finance Committee on Friday, November 4. A Finance Committee call is scheduled November 18 to review the proposed budget and another call is scheduled November 29 to seek endorsement of budget by the Finance Committee. Treasurer Henning will present CCT endowment status to the board in his Treasurer's Report. Trust Agreement is in review by counsel and will be up for vote at December 5 Trustee Meeting. CCS will be presenting their interim report to the Executive Committee on Wednesday, November 2. Task list review: President Smith's tasks are in progress. President Smith has spoken with two potential custodians as alternatives to CCT.

New Business: Mr. McGonegle volunteered to act as liaison between Finance and Audit Committees. Bookkeeper, Laura Flamion was introduced to the Committee.

On motion by Mr. Joyce and second by Mr. McGonegle, the meeting adjourned at 11:55am Central Time. Next meeting is scheduled November 18 at 10:00am Central Time via conference call.

Task		Assigned to		Due date
Discuss rules about reporting outstanding grant payments with Sassetti		Eric Smith		12/31/16
Create template for COI requirements		Eric Smith		12/31/16
Suggest alternatives to CCT		Eric Smith		12/31/16
Show Temporarily Restricted Equity as Permanently Restricted on Balance Sheet		Laura Flamion		11/18/16
Provide 2017 Proposed Budget to Finance Committee		Eric Smith		11/4/16
Provide CCT endowment status to Board in Treasurer's Report		Ray Henning		11/21/16

The TREE Fund
Balance Sheet
As of October 31, 2016

		Oct 31, 16
ASSETS		
Current Assets		
Checking/Savings		
1003 · Petty cash		334.58
1004 · PNC- 4549 operating		1,000.00
1006 · Wintrust		613,005.23
Total Checking/Savings		614,339.81
Accounts Receivable		
1100 · Accounts Receivables		36,884.18
1510 · Pledge Receivables		43,606.50
1510.1 · Discount on pledge receivables		-3,455.00
Total Accounts Receivable		77,035.68
Other Current Assets		
Prepaid expenses		
1491 · Prepaid Postage	169.33	
1492 · Prepaid Insurance	6,040.00	
1493 · Prepaid Other	319.94	
Total Prepaid expenses		6,529.27
Investments held at CCT		
CCT - Permanently Restricted		
1520.99 · General Endowment Fund	186,893.94	
1520.61 · Bartlett Fund	44,146.23	
1520.91 · Bob Skiera Memorial Fund	328,426.02	
1520.92 · OH Chapter ISA End. Fund	110,776.26	
1520.30 · Safe Arborist Techniques Fund	265,190.58	
1520.94 · Collier Fund	146,845.00	
1520.41 · Barborinas Fund	70,176.63	
1520.51 · Frank Gamma Arbor. Ed. Fund	143,128.01	
1520.13 · John White Fund	64,048.20	
1520.22 · Dr. Mark McClure Research Fund	122,111.13	
1520.81 · IL Arborist Association Fund	45,108.95	
1520.12 · John Wright Memorial Schol Fund	27,156.12	
1520.71 · Utility Arborist Research Fund	609,316.68	
1520.95 · Bonnie Appleton Memorial Fund	71,205.01	
1520.11 · John & Evelyn Duling End Fund	528,259.81	
1520.21 · Robert Felix Memorial Fund	627,239.03	
Total CCT - Permanently Restricted	3,390,027.60	
Total Investments held at CCT		3,390,027.60
Total Other Current Assets		3,396,556.87
Total Current Assets		4,087,932.36
Fixed Assets		
1600 · Fixed Assets		30,120.00
1699 · Accum Depreciation		-30,120.00
Total Fixed Assets		0.00
TOTAL ASSETS		**4,087,932.36**
LIABILITIES & EQUITY		
Liabilities		
Current Liabilities		
Accounts Payable		
2000 · Accounts Payable		72,273.03
2050 · Grants Payable		214,341.75
Total Accounts Payable		286,614.78
Other Current Liabilities		

The TREE Fund
Balance Sheet
As of October 31, 2016

	Oct 31, 16	
2450 · Accrued PTO		16,988.61
Total Other Current Liabilities		16,988.61
Total Current Liabilities		303,603.39
Total Liabilities		303,603.39
Equity		
3200 · Unrestricted-Operating		
3200.01 · Prior Period Adjustments	2,200.00	
3200 · Unrestricted-Operating - Other	193,017.40	
Total 3200 · Unrestricted-Operating		195,217.40
3600 · Temporarily Restricted		240,000.00
3800 · Permanently Restricted		3,390,025.00
3900 · Retained Earnings		103,013.11
Net Income		-143,926.54
Total Equity		3,784,328.97
TOTAL LIABILITIES & EQUITY		**4,087,932.36**

The TREE Fund
Profit Loss Budget vs. Actual
January through October 2016

	Jan - Oct 16	Budget	Over Budget	% of Budget	Annual Budget
Ordinary Income/Expense					
Income					
4001.00 · Annual Oper Campaign Unrestrict	162,942	135,000	27,942	120.7%	188,000
4100.00 · Other Income	464	2,300	(1,836)	20.19%	3,000
4500.00 · Special Event ISA Conference	89,320	70,000	19,320	127.6%	70,000
4700.00 · Sponsored Grants/Scholarship	651,683	320,000	331,683	203.65%	331,000
4900.00 · Special Event Tour Des Trees	554,941	575,000	(20,059)	96.51%	575,500
Total Income	1,459,351	1,102,300	357,051	132.39%	1,167,500
Gross Profit	1,459,351	1,102,300	357,051	132.39%	1,167,500
Expense					
6010.00 · Board & Liason Expense	5,294	8,000	(2,706)	66.17%	16,000
6020.00 · Grants and Contracts	283,099	275,000	8,099	102.95%	450,000
6050.00 · Occupancy & Equipment Expense	20,859	23,000	(2,141)	90.69%	28,000
6100.00 · Office Expense	25,002	28,000	(2,998)	89.29%	32,000
6150.00 · Personnel Expenses	285,145	314,000	(28,855)	90.81%	380,700
6200.00 · Professional Fees	82,974	23,000	59,974	360.76%	25,000
6300.00 · Service Fees	7,537	9,000	(1,463)	83.74%	12,000
6500.00 · Special Event ISA Conference	15,001	23,000	(7,999)	65.22%	23,000
6900.01 · Special Event Tour des Trees	141,177	187,000	(45,823)	75.5%	193,000
7000.00 · Technology Expense	14,586	19,000	(4,414)	76.77%	25,000
7100.00 · Travel & Meetings	20,724	33,200	(12,476)	62.42%	39,200
Total Expense	901,397	942,200	(40,803)	95.67%	(56,400)
Net Ordinary Income	557,954	160,100	397,854	348.5%	**(56,400)**
Other Income/Expense					
Other Expense					
8999 · Transfers To/From Restricted	702,650 [1]				
Total Other Expense	702,650				
Net Other Income	(702,650)				
Net Income	**(144,696)**	**160,100**	**(304,796)**	**-90.38%**	**(56,400)**

Notes to the financial statements:

1 Transfer to temporarily restricted net assets $240,000 UAR donation for use in the upcoming grant cycle.

Transfer to permanently restricted net assets $462,650

Transfer to permanently restricted net assets not yet reflected in the CCT financial summary $100,994

TREE FUND

Cultivating Innovation in Arboriculture and Urban Forestry

552 South Washington Street, Suite 109, Naperville, Illinois 60540 630-369-8300 **www.treefund.org**

Investments Managed by Chicago Community Trust

reconcilation as of 9/30/16

		Permanently Restricted Funds:	**12/31/2015 Balance**	**Addition: 2016 income**	**Subtotal**	**YTD Net Change in Asset**	**9/30/2016 Balance**
1520.41	BRB	Barborinas Fund	65,076	5,076	70,152	2,933	73,084
1520.51	GAM	Frank Gamma Arbor. Ed. Fund	143,126	2	143,128	6,450	149,578
1520.13	WHI	John White Fund	59,332	4,716	64,048	2,674	66,722
1520.22	MCC	Dr. Mark McClure Research Fund	122,111	-	122,111	5,503	127,614
1520.81	IAA	IL Arborist Association Fund	43,891	1	43,892	1,978	45,870
1520.30	SAT	Safe Arborist Techniques Fund	251,058	13,776	264,834	11,314	276,148
1520.12	WRI	John Wright Memorial Schol Fund	27,153	3	27,156	1,224	28,379
1520.71	UAR	Utility Arborist Research Fund	362,441	156,701	519,142	16,333	535,475
1520.94	CATT	Collier Arborist Training Trust	-	145,385	145,385	-	145,385
1520.92	OHC	Ohio Chapter ISA End. Fund	113,656	-	113,656	5,122	118,778
1520.95	APP	Bonnie Appleton Memorial Fund	55,135	14,473	69,608	2,485	72,092
1520.92	SKI	Bob Skiera Memorial Fund	299,359	20,022	319,381	13,490	332,871
1520.11	DUL	John & Evelyn Duling End. Fund	528,258	2	528,260	23,805	552,065
1520.21	FEL	Robert Felix Memorial Fund	625,792	1,447	627,239	28,200	655,440
1520.61	BRT	Bartlett Fund	44,096	50	44,146	1,987	46,133
1520.99		Other Unallocated Funds	186,892	-	186,892	8,422	195,314
		Total Permanently Restricted	**2,927,376**	**361,655**	**3,289,031**	**131,918**	**3,420,950**
		Total Investments at CCT	**2,927,376**	**361,655**	**3,289,031**	**131,918**	**3,420,950**

TREE FUND
Cultivating Innovation

Development Committee Report
Prepared by: Brian Sayers, Chair
Date Submitted: 11/18/2016

The Development Committee is charged with the following:

Basic Function: Responsible for the leadership and oversight of fund development activities and external communications of the organization

Responsibilities:

- Oversees the creation and execution of the TREE Fund's development plan to effectively promote the organization, raise awareness about our mission, expand the donor base, develop new funding sources and coordinate planning giving materials.
- Reviews quarterly reports on fund development activities.
- Reviews quarterly reports on communications activities.
- Reviews and recommends budget line items, revenue and expenses for fund development and communication activities.
- Reviews annually basis the revenue sources for the organization in conjunction with the Finance Committee

Related Strategic Initiatives:

- To increase awareness and understanding of the TREE Fund's mission by existing and emerging constituencies
- To increase awareness of our programs
- To increase financial support of programs
- To increase unrestricted gifts in number and amount
- To diversify operating income

Projected Outcomes:

- Increased awareness of TREE Fund
- Diversified revenue streams to support the growth of our operations and endowment

Meetings:

On October 18th, The Development Committee held a joint conference call with CCS

- At that time we were informed by CCS that a procedure for our current fund drive will be to acquire something like 200 significant gifts rather than 2000 smaller ones – which has been our method in the past.
- We were also informed that none of the current board members would be making one of the desired significant initial gifts to the campaign.
- While this in itself is not a good sign, it does not preclude a successful campaign.
- CCS outlined many of their campaign features, explaining how potential donors are contacted and how they are gradually lend into a situation where they are ready for an "ask."
- Overall they provided an early indication that the goal of our campaign (raise the endowment by $5 million) seemed to be achievable.

Subsequent to that meeting all members of the Development Committee were asked to comment on the following:

- What prospects or ideas do you have for contacting potential donors especially those outside the green industry?
- What insights or observations can you make concerning the notion of 200 gifts rather than 2000?
- Please read the following articles and comment on their possible significance and use in our upcoming campaign:

- Nik Sawe and Brian Knutsen: Pictures of threats increase speed and amount of donations (a precis is copied below)

A Penny For Your Thoughts

By Cameron Walker

Do pretty pictures inspire people to donate? Research shows photos of park threats may raise money faster.

Picture your favorite vista from a national park. If you're a Yosemite fan, it might be the view of Half Dome's granite. Or maybe your pick is the dependable glory of Old Faithful, the orange-colored glow of Delicate Arch at sunset, or the reflection of Mount Rainier in Mirror Lake. Now imagine photos like these arriving in your mailbox along with a pre-addressed envelope for your

donation. What makes you choose between writing a check and tossing the whole thing in the recycling bin?

What makes you choose between writing a check to an environmental group and throwing a request for a donation in the recycling bin? © IAN DODDS

In recent years, environmental scientists and economists have tried to figure out exactly this: how we decide how much we're willing to pay to protect wilderness. And with natural areas under threat from both climate change and development, the question is more important than ever. But determining what influences our decisions when it comes to supporting conservation can be tricky. Is it the memory of peering over the Grand Canyon's South Rim for the first time that makes us want to contribute to national parks? Or is it actually the fear of losing pristine landscapes that drives us to donate?

Previously, researchers have conducted surveys to try to understand how people value these hard-to-quantify aspects of wilderness. But to get a more precise answer, scientists have now turned to the wilderness within: our brains.

At Stanford University, Nik Sawe, an environmental neuroeconomist, and psychologist and neuroscientist Brian Knutson are using functional magnetic resonance imaging (fMRI) to map the brain's activity as people decide how much they're willing to pay to protect nature. As part of a recent study, 20 people lay inside an MRI scanner and looked at series of images of national parks and California state parks while researchers captured brain scans.

First, subjects looked at a picture of a park with its name. Next, they saw that picture with a second image of a proposed use of a portion of park land—either something destructive like mining or more innocuous like hosting a children's nature camp—superimposed on it. Finally, participants were asked whether they would contribute a specific amount of money to help prevent this use. Along with hourly payment for the study, all participants were given $24 that they could choose to donate.

Each participant saw more than 70 sets of park images, potential threats, and donation requests. Researchers explained that one of these donation decisions would be binding, meaning that any money that people decided to donate on that trial would be given to either the National Park Foundation or the California State Parks Foundation.

While the specific threats were hypothetical, an actual budget crisis in California was rocking state parks when Sawe and Knutson began designing the study in 2012. The state talked about closing 70 of 278 state parks, and legislators debated privatizing several others. (A year later, the federal government shutdown led to a 16-day closure of national parks.) Many of the scenarios the researchers set up for each park were based in reality, too. Before the experiment, the conservation group Environment California had identified more than 185 gold mining claims within 10 miles of Yosemite National Park that it said could lead to heavy metal contamination inside the park.

Parks = Health

Born with a brittle bone disability, researcher Nik Sawe feels connected to national parks because they were his personal litmus test as a child. “Whenever I was able to go out into nature, to Yosemite or Yellowstone, it took on a special significance because it was a sign that I was in really good health,” he said.

In their study, which appeared in the November 15 issue of the journal NeuroImage, the researchers reported that looking at images of the parks activated a region of people’s brains associated with rewarding experiences, from eating fine food to enjoying financial success, called the nucleus accumbens. And the more iconic a park was—Yosemite, for example—the more activity this region experienced.

What was surprising, though, was that the positive feelings associated with the parks weren’t what seemed to tip people toward donating.

Many studies on philanthropy, Sawe said, show that the motivation for contributing to a cause seems to come from feeling good about giving. But the Stanford researchers found that participants’ reactions to park threats may play a bigger role in triggering donations than the “warm glow of altruism.” The anterior insula, a region of the brain associated with negative emotions including disgust and outrage, was more active when participants saw proposed uses that were destructive to the park landscape. What’s more, activity in the anterior insula was significantly stronger in people who possessed pro-environmental attitudes, and this activity actually predicted donation. The more active the anterior insula was, the more likely people were to donate.

In short, people’s negative reaction to the threat of mining or oil extraction eclipsed even the positive feelings they had for the parks in motivating them to act. “It turns out people, and their brains, respond both to the good and the bad—and the bad really matters,” Knutson said.

Knutson said that scientists used to think of emotions as pesky things that interfered with research about how people make choices. But they’ve since found that they play a huge role in decision-making. Making people aware of potentially destructive forces could help those interested in preserving parks rally more support, he said.

Sawe now wants to work with conservation groups to see if brain activity can predict which national environmental campaigns are likely to meet their funding goals, and to look at how proximity to a threatened area affects people’s responses to different campaigns. “We need to make it easier for people to make the right decisions,” he said, “for the environment and ourselves.”

- Geoffrey Donovan : The Relationship Between Trees and Human Health

  The following is an introduction to research into health problems occurring after most ash trees have been removed from a locale: Copied below is Donovan's introduction to this study.

The Relationship Between Trees and Human Health: Evidence from the Spread of the Emerald Ash Borer

Geoffrey H. Donovan, PhD, David T. Butry, PhD, Yvonne L. Michael, ScD,
Jeffrey P. Prestemon, PhD, Andrew M. Liebhold, PhD,
Demetrios Gatziolis, PhD, Megan Y. Mao

Background: Several recent studies have identified a relationship between the natural environment and improved health outcomes. However, for practical reasons, most have been observational, cross-sectional studies.

Purpose: A natural experiment, which provides stronger evidence of causality, was used to test whether a major change to the natural environment—the loss of 100 million trees to the emerald ash borer, an invasive forest pest—has influenced mortality related to cardiovascular and lower respiratory diseases.

Methods: Two fixed-effects regression models were used to estimate the relationship between emerald ash borer presence and county-level mortality from 1990 to 2007 in 15 U.S. states, while controlling for a wide range of demographic covariates. Data were collected from 1990 to 2007, and the analyses were conducted in 2011 and 2012.

Results: There was an increase in mortality related to cardiovascular and lower-respiratory-tract illness in counties infested with the emerald ash borer. The magnitude of this effect was greater as infestation progressed and in counties with above-average median household income. Across the 15 states in the study area, the borer was associated with an additional 6113 deaths related to illness of the lower respiratory system, and 15,080 cardiovascular-related deaths.

Conclusions: Results suggest that loss of trees to the emerald ash borer increased mortality related to cardiovascular and lower-respiratory-tract illness. This finding adds to the growing evidence that the natural environment provides major public health benefits.

(Am J Prev Med 2013;44(2):139 –145) Published by Elsevier Inc. on behalf of American Journal of Preventive

Accomplishments:

- Discussion of these issues has not been extensive. As a whole I believe the Development Committee is on hold until the final report from CCS is delivered and evaluated.

- The Executive committee has begun efforts to enlist a new Chair of the Development Committee. They feel that it would not be most productive for the incoming chair to hold that position as well.

Next Meeting:

TBD

Research & Education Committee Report

Prepared by: Hallie Dozier, Chairman
Date Submitted: November 21, 2016

The Research & Education Committee is charged with the following

Basic Function: Review and selection of research grant, scholarship, and education grant applications.

Responsibilities: Meet regularly with Research and Education sub-committees to review and select applications for scholarships and educational grants.

Related Strategic Initiatives:

Goal 2.1: Determine what we should fund in education and research
Goal 2.2: Manage the processes around making grants and awarding scholarships

Committee Activities.

- The **Research Sub-Committee** met twice via telephone on **November 8**; the first group met to review and select projects for the **John Duling Research Grant Program**, and the second group met via telephone to review and award projects submitted to the **Kimmel Research Grant Program**.
- **TREE Fund received 37 Kimmel applications**; Chairman Dozier eliminated 19 for not meeting program criteria, leaving 18 for committee review.
- Cathy Bentley, Dan Struve, Jim Urban and Chip Brown reviewed these proposals and submitted rankings. Hallie Dozier, Dan Struve and Cathy Bentley participated in the call to discuss the Kimmel applications. Jim Urban recused himself from this discussion due to a potential conflict of interest, and prior to discussion, we eliminated his scoring of the applications for the same reason.
- **TREE Fund received 38 proposals for the John Duling Research Grant**. Prior to review by committee, Chairman Dozier eliminated 15 of these applications for not meeting program criteria, leaving 23 proposals for committee review. Jim Barborinas, George Hudler, Beau Broadbeck, Robert Vanderhoof and Hallie Dozier reviewed these proposals and submitted rankings. Hallie Dozier, Jim Barborinas, Beau Brodbeck, George Hudler, Ward Peterson, and Robert Vanderhoof participated in the review call.

Other items:

The large number of proposals eliminated from review cycles due to program incompatibility raises the question of whether or not it is time for TREE Fund to consider internally driving development of new granting programs. Since the launch of the Kimmel ***International*** Grant Program, we have seen a steep rise in the number of applications from abroad – in particular from developing areas. A few are “traditional” research and so qualify for research grants, but several

would better fit as education programs, and so are eliminated from consideration for research funding *a priori*. Unfortunately, because the education grants we currently offer are restricted domestic K-12 audiences, these proposals also fail to qualify for consideration for education programs. This effectively eliminates the possibility of TREE Fund supporting quality extension/demonstration projects that target a wider age range, and it eliminates the possibility of supporting projects outside of the USA. For example, several worthy community forestry projects from Africa and India – worthwhile, well designed projects that address a real need – have been eliminated from consideration automatically because TREE Fund does not have a funding vehicle that might accommodate such projects.

I urge the Board of Trustees to consider broadening the scope of service beyond current parameters and to examine the potential to develop a vehicle for funding research/demonstration/extension programs that serve a wider audience than we serve at this time.

Funding Recommendations:

We evaluated three Duling project proposals as grant-worthy. **The committee recommends the following projects for funding through the John Duling Research Grant Program** (see **Appendix A** for project summaries):

1. Dr. Adam Berland: “Evaluating virtual street tree surveys as a tool for municipal forest management” $23,030.
2. Dr. Justin Morgenroth: “Measuring tree response to increasing root removal intensities” $24,977.
3. Dr. Brian Kane: “Measuring forces at multiple locations in rigging systems” $25,000.

We evaluated two Kimmel projects as grant-worth. **The committee recommends the following projects for funding through the Jack Kimmel International Research Grant Program (note: CTF will fund one, TF will fund one)** (see **Appendix B** for project summaries):

1. Dr. Francesco Ferrini: “Effect of topping on microclimate condition and human comfort” $10,000.
2. Dr. Camilo Ordonez: “Investigating Street Tree Decline and Mortality in Commercial Urban Spaces Revitalized with Structural Soil Cell Technology to Improve Planting and Maintenance Practices” $10,069.

Objectives for next 3 weeks:

Transition committee chairmanship to George Hudler.

Appendix A: John Duling Research Grant Program – summaries of projects recommended for funding

Dr. Adam Berland, Ball State University, Muncie – *Evaluating virtual street tree surveys as a tool for municipal forest management* $23,030

Street tree inventories are critical to municipal forest management, but many communities cannot afford to conduct field-based inventories. It is possible to characterize street trees by manually interpreting images in Google Street View, which offers a free and user-friendly platform for accessing ground-level photographs taken along roads throughout the USA. We previously conducted a proof-of-concept study demonstrating that a 'virtual survey' in Street View can produce reasonably accurate data about street tree variables relevant to municipal management such as tree abundance, genus, and size class. However, that virtual survey was conducted by a single analyst with expertise in urban forest inventories, so we do not know how well this approach can be carried out by less experienced municipal staff or citizen scientists.

This project will build upon existing research to improve our understanding of the possibilities and limitations of conducting virtual street tree surveys in Google Street View. We will enlist analysts ranging from experts to novices to conduct virtual surveys to record basic tree attributes, and their performance will be evaluated against field data from the same set of streets. We are primarily interested in determining (1) what overall level of data quality can be generated using a virtual survey approach as compared to field surveys; and (2) how data quality varies according to the analyst's level of expertise, and whether citizen scientists can generate reliable data for management purposes. Our results will provide guidance for communities considering implementing this innovative approach for generating street tree inventory data.

Dr. Justin Morgenroth, University of Canterbury, Christchurch - *Measuring tree response to increasing root removal intensities* $24,977

Conflicts often exist between trees in the urban forest and an ever increasing number of buildings, footpaths, new infrastructure and underground utilities. Such conflicts frequently result in the damage or complete removal of tree roots. While avoiding root damage is the most effective strategy for preserving tree health, site constraints can put trees in close proximity with development activities. Currently, arboricultural specialists rely on industry best practice documents informed by relatively few studies when deciding if a given tree can be retained or should be removed during site development. These documents feature largely anecdotal root diameter thresholds for identifying acceptable root removal limits. These thresholds fail to account for the size of the root(s) relative to the size of the tree, and also the total number of roots to be removed. Current best management practices (BMPs) also fail to account for the cumulative effects of repeated root injury resulting from site development and eventual redevelopment or repair.

Funding is requested to help further understand the implications of root removal by examining precisely how trees respond to different root removal intensities. The study proposes to monitor physiological and tree growth responses to various root removal treatments in order to provide information to assist with the proper

management of urban trees. The study has been designed to answer the questions; “How do trees respond to increasing root pruning intensity?” and “what proportion of a tree’s root system can be removed without significantly affecting growth and function?”

Dr. Brian Kane, University of Massachusetts, Amherst - *Measuring forces at multiple locations in rigging systems* $25,000

Arboricultural rigging carries a very high degree of risk. Climbers must estimate how much force will be generated when rigging pieces of wood, and where the cut pieces will move when being rigged. Heavy pieces of wood swinging around or shock-loading the tree have very high momentum. If they collide with the climber or the tree, severe or fatal injury, tree failure, or both can be the result. Despite the risk and the development of new gear and techniques intended to reduce the risk, very few rigorous studies have quantified the forces generated while rigging, making it impossible to know with certainty whether new gear or techniques actually reduce the risk. This proposal describes a project to measure rigging-induced loads at multiple points in a rigging system, and compare the effect of varying components of a rigging system on the loads. In particular, a variety of ropes, blocks, and rigging loads will be tested to determine their effect on loads measured at different points in the rigging system.
These measurements will be used to determine the friction in rigging blocks and lowering devices (e.g., Port-A-Wrap, GRCS). Understanding the effect of friction has important implications for safety. Depending on the amount of friction in a rigging block, failure of the rigging rope or the anchor point (block, sling, or tree) will be more likely. Knowing how much friction a lowering device provides helps tree workers anticipate how many wraps on a lowering device are needed to carry an expected load.

Appendix B: Jack Kimmel International Research Grant Program – summaries of projects recommended for funding

Francesco Ferrini, University of Florence, Florence - *Effect of topping on microclimate condition and human comfort* $10,000

Urban trees create many benefits in terms of thermal comfort and Urban Heat Island (UHI) mitigation during the summer season. These benefits are strictly linked to tree canopy, but the management of the trees in the urban environment includes pruning activities.
The aim of this work is to evaluate the effects of topping on microclimate conditions in the area where tree are planted. We hypothesized that topping can affect temperature of air and soil and air relative humidity. Thus, we want to test the hypothesis that topping do not only depress tree health, but also directly reduces thermal comfort and human well being in cities. The experiment will be conducted using 96 15-year-old maple (Acer spp.) and linden (Tilia spp.) trees. Half of them will be topped in late winter, while the remaining half will be left unpruned, according to a randomized block statistical design with 4 replicates. Sensors for measuring air temperature and relative humidity during the summer season have been placed in early summer 2016 in the area of research. After topping tree growth and physiology will be checked and air and soil temperature, and air relative humidity will be continuously monitored for two years and the effect on human comfort will be calculated by applying biometeorological indices.

Camilio Ordonez, Ryerson University, Toronto - *Investigating Street Tree Decline and Mortality in Commercial Urban Spaces Revitalized with Structural Soil Cell Technology to Improve Planting and Maintenance Practices* $10,069

The challenge of growing trees in commercial and highly-urbanized areas in cities will affect the success of the urban forest enhancement agenda, which is the focus of urban forest management across North America. Structural soil cell technology can improve habitat quality for trees in these spaces and was used most recently to plant trees as part of Toronto's Bloor Street revitalization. These trees faced subsequent decline and high mortality. There is a lack of research on these landscapes and this technology, so it is unclear why these trees failed. Assessing the factors that contributed to their decline and mortality is necessary to guide future decisions about the use of this technology. This will ensure the success of the urban-forest enhancement agenda, reduce costs of tree planting and maintenance, and help companies and cities develop sound guidelines for street plantings in commercial and highly-urbanized areas in cities. This research project will analyse already-existing soil and biophysical data from the Bloor Street trees and use multi-variate regression and contingency analysis techniques to elucidate the factors that have contributed the most to tree decline and mortality in Bloor Street. The information emanating from this project will be made accessible to urban forest managers and other stakeholders through research reports, academic publications, workshops, conference presentations, and webinars, and train one Canadian student in contemporary urban forest issues.

TREE FUND
Cultivating Innovation

Governance Committee Report
Prepared by:Steve Geist, Chair
Date Submitted: November 17, 2016

The Governance Committee is charged with the following

Basic Function: The Governance Committee is Responsible for managing the process of soliciting new board members. It has the direct responsibility for coordinating the board's composition, development, evaluation and internal processes.

Responsibilities: To prepare priorities for board composition.

Draft a recruitment plan and continuously cultivate new prospects.

To meet with prospective board members and recommend candidates to the board.

To recommend a slate of officers to the board. Develop job descriptions for board members
Orientate new board members and provide continuing education of all members on their responsibilities.

Ensure that the board regularly engages in self-assessment

To suggest new, non-board individuals for committee membership.

Related Strategic Initiatives:

The committee is presenting the restatement of the Declaration of Trust for board approval. Eric Smith and Barb Duke are staffing and supporting each of the standing committees. Standing committees have monthly or regularly scheduled conference calls.

Meetings:

		Oct 19 2016	Nov 9 2016
Attending			
Chair	Steve Geist	P	P
Trustee	Brent Asplundh	A	E
Committee	Dennis Beam	E	E
Trustee, treasurer	Ray Henning	P	P
Trustee	Tom Wolf	P	P
Guest	Randy Miller		P
Staff	Barb Duke	P	P
Staff	Eric Smith	P	P

P – present A – absent E – excused

Topics and Action Items

- Al West has offered several constructive comments and observations in regards to the Trust Agreement. Several members of the committee have contacted Al on specific pieces.
- Al West is being asked to draft a history of the TREE Fund.
- As a measure of board self-assessment, the Governance Committee is asking each of the standing committee chairs to assess how their committees supported the TREE Fund strategic plan in 2016.
- Restatement of Declaration of Trust. The Governance Committee will recommend to the Board of Trustees to approve this document via 4 motions as follows.
    - Change of trustee terms to (3) 2-year terms. Executive committee terms of 1 year each.
    - Permanently restricted funds are being held in perpetuity.
    - Omit trustee compensation.
    - All other verbiage changes.

Accomplishments:

- Tom Wolf accepted nomination for Vice Chair in 2017.
- Sharon Lilly nominee for TREE Fund Board of Trustees.
- Re-statement of Declaration of Trust.

Committee work supporting the 2015 – 2017 strategic plan.

The following is considering the 5 goals set forth for the committee:

- Engage trustees in our mission. Yes, I believe we have achieved this goal.
- Ensure that 100 percent of the trustees have the TREE Fund as 1 of their top 3 volunteer activities. Unknown.
- Trustee succession plan
    - The short answer is no, there is not a universal succession plan.
    - A strategic breakfast meeting was held at the ISA Conference in August. There we further defined who we are looking for in new trustees. Diversity and leadership experience is our focus.
    - A running list of potential trustees with contact information has been prepared and distributed to the governance committee.
    - We did revise terms of office that will further define a succession plan (Trust Agreement).
    - We do have and will have going into 2017; 13 – 15 qualified trustees on the board.
    - We are also revising our trustee orientation materials and processes.
- Committee succession plan
    - The short answer is no, there is not a succession plan for all committees.
        - The liaison committee documents have been revised and consolidated into 1 document. The liaison committee has been tasked with establishing terms for ISA chapter liaisons.

Objectives for the first quarter of 2017:

- Recruitment of another trustee.
- Seek a chair for Development Committee, if not accomplished in December.
- Look at the standing committee structures and standardize. The current committee staffing is not consistent with individual committee governing documents. Amend documents and / or adjust committee members.
- Put together a spreadsheet of pertinent TREE Fund documents and when the last revision date was.
- Challenge the committee chairs to identify a successor to chairpersonship.

Next Meeting Date:

December 14, 2016

Liaison Committee Report
Prepared by: Beau Brodbeck, Chair
Date Submitted: November 18, 2016

The Liaison Committee is charged with the following

Basic Function: To establish and maintain a sound, dynamic relationship between ISA Chapter Officers, members and other supporting organizations and the TREE Fund Board and Staff. Each Liaison serves as the primary communication link between their supporting organization and the TREE Fund. Liaisons are an essential part of the TREE Fund leadership team and must have the appropriate forums for relating information and issues to both their organization and the TREE Fund.

Responsibilities:

- Participate in their Chapter's Board meetings;
- Utilize their Chapter's communications tools to keep the membership informed about current TREE Fund opportunities, events and achievements;
- Establish regular, proactive communication with the TREE Fund Board and staff regarding relevant opportunities and issues within their Chapter;
- Facilitate the inclusion of a TREE Fund exhibit booth at their Chapter's annual conference or meeting;
- Ensure that time is scheduled on the agenda of their Chapter's general membership program for a TREE Fund presentation;
- Assist the TREE Fund Development Committee members and staff with identification and solicitation of potential funding sources and donors within your Chapter;
- Encourage strategic alliances with other stakeholder groups to enlist their support of the TREE Fund;
- Assist their Chapter in reaching its goal in the TREE Fund Chapter Challenge program by involving the membership in fundraising projects such as Tour des Trees, "Raise Your Hand for Research" auction, local auctions, golf tournaments, etc.;
- Communicate to the TREE Fund Research Committee research and education topics of special concern to their Chapter members;
- Encourage past TREE fund grant recipients to participate in Chapter education programs to communicate research results and the value of TREE

Fund-sponsored projects; and

- Be an advocate for the TREE Fund and arboriculture research and technology transfer in general.
- **Provide mentorship for TREE Fund scholarship recipients within your chapter. Also be available to assist in mentoring scholars from other chapters with your specific area of expertise.**

Related Strategic Initiatives:

- Identify and Connect to New Resources
- Evaluate Potential Relationships with Possible Funding Sources
- Ensure User Groups Know What We Have Accomplished
- Target Constituencies for Feedback

Meetings Attendance and Known Liaison Status:

Chapter	Name	Liaison Status	Dec. 7, 2015	March, 2016	Sept., 2016
Florida	Eric Hoyer	1	X	X	X
Illinois	Mark Younger	1		X	X
Indiana	Tom Ordway	1	X		X
Kentucky	Dave Leonard	2		X	X
Michigan	Kathy Gilmour	3	X	X	X
Mid-Atlan.	Doug Peterson	3	X	X	X
Midwestern	Jeff Iles	2		X	X
Minnesota	Ryan Gustafson	1	X	X	X
New England	Jeff Carney	3			
New Jersey	Todd Mastrobuoni	3	X*	X*	X
New York	Frazer Pehmoeller	1	X	X	
Ohio	Susan Paul	3			
Pacific NW	Wendy Robinson	1		X	X
Penn-Del	Kristin Wild	1		X	X
Rocky M.	Jon Elliott	3	X***	X	X
Southern	Beau Brodbeck	1	X	X	X
Texas	Gene Gehring	3	X	X	X
Utah	Shirl McMayon	3	X	X	X
Western	Rick Cober	3			
Wisconsin	Nate Schuettpelz	3			
Staff	Mary DiCarlo		X	X	
Staff	Karen Lindell			X	X
Staff	Eric Smith				X

1. In place, stable no known changes in next 12 months.
2. Vacated or looking to vacate and appoint new liaison within 6 months
3. New Liaison within the past 12 months

Green Vacant positions
* Represented by Steve Chisholm
** Represented by Adam Alves
*** Represented by Steve Geist
**** Represented by Laurie Skull

Accomplishments:
The liaison committee has 3 liaisons for Ohio, Western, and Wisconsin Chapters. On October 14 we had an "Onboard Welcoming" conference call for the new liaisons with Karen Lindell. Two of the new liaisons were able to join us (Nate Schuettpelz from Wisconsin Chapter and Susan Pual from Ohio Chapter). Both were enthusiastic and positive and will make excellent liaisons. I have not reconnected with Rick Cober but hope to meet him in December.

Mentoring of Tree Fund scholarship recipients is underway. Kristin Wild (Penn-Del Chapter) has agreed to mentor, and recruit other mentors, for two students in her chapter Allison Wilson and Thomas McNulty. Jeff Carney (NE Chapter) has agreed to mentor Conor Smith.

As we look forward to our December Liaisons meeting Karen and I have developed a full agenda to update, gain feedback and discuss the changing roles of liaisons in 2017. Items on our agenda include:

1. News update – includes grants, webinars, endowment building campaign, Tour past and future and booth materials.
2. Feedback session – provides staff an opportunity to hear liaison feedback on bulletins, web-resources and other liaison needs.
3. Changing liaison roles – session to discuss formalizing liaison roles, term limits, conference class and annual retreat locations.
4. Shifting away from chapter challenge – introduce liaisons to chapters being recognized as corporate partners and discuss streamlined and budget driven chapter donations.
5. Fundraising idea swap – a valuable exercise to learn from other chapters' success.
6. Open discussion

What's your committee done this year to support the strategic plan?
At our upcoming December liaison meeting we will be discussing the following strategic plan related topics:

1. Formalizing liaison roles with chapters
2. Placing time limits on liaisons

Objectives for the Next 3 Months:

Task		Assigned to		Due date
Develop themes for bimonthly conference calls		liaisons		December 2016
Discuss new locations for liaison retreat		liaisons		December 2016
Formalized liaison roles in chapters		Liaisons		Ongoing
Streamlining chapter donations with budgets		Liaisons		Ongoing

Next Meeting:

December 5, 2016, Chicago, IL

Audit Committee Report
Prepared by: Chair Will Nutter
Date Submitted 11-18-16

The Audit Committee is charged with the following:

Basic Function: The Audit Committee is to provide independent oversight of the financial reporting, the system of the internal financial controls and the decisions surrounding accounting policies of the Tree Fund. The Committee also selects independent accounts to perform the annual audit and prepare the Fund's tax returns. It is also charged with the recommending to the Tree Fund Board of Trusties changes in policies, procedures or internal controls concerning the Fund's financial recording and reporting systems.

Responsibilities: The Audit committee shall appoint and approve the independent auditors. The audit committee shall review and approve the audit plan and scope. The Audit committee shall review accounting policies and practices with auditors. The audit committee shall review legal and regulatory matters with auditors. The audit committee shall review and approve the audited letter. The audit committee shall review the audit schedule of differences. The audit committee shall evaluate the independent auditors.

Related Strategic Initiatives: Award of new three-year agreement to Sassetti LLC after going through the formal RFP. Board approved and agreement signed.

Meetings: Please include dates, those who participated, topics and actions. No meetings since our last board meeting. We did add a member to our committee as a liaison with the finance committee. Terry McGonegle will be joining our committee going forward.

Accomplishments:

What has your committee done this year to support the strategic plan? Successful RFP process to evaluate and award a new agreement with Sassetti LLC.

Objectives for the next 3 months: Onboard Sassetti LLC
Meeting scheduled for Jan 6th 2017, April 14, 2017, September 14th 2017, December 15, 2017.
Meeting with Sassetti LLC to review the audit and start the process of educating and onboarding.

Next Meeting Date: January 6th 2017.

TOP LEVEL SUMMARY OPERATING BUDGET ($3.0 MILLION CAMPAIGN)

	FY 2016		FY 2017	
	BOARD APPROVED ANNUAL BUDGET	ESTIMATED YEAR-END RESULTS	REQUESTED BUDGET	NOTES
INCOME:				
Unrestricted Operating Funds	$188,000	$205,000	$184,500	Impact of Campaign on Operations (10% reduction)
Other Income	$3,000	$2,000	$10,000	Launch online point of sale system; less trade show sales
Special Events: ISA Conference	$70,000	$91,000	$0	Now Part of Tour; See Consolidated Special Events Tab
Restricted Income	$331,000	$780,000	$665,000	See Campaign Cash Flow Tab
Special Events: Tour des Trees	$575,500	$600,000	$685,000	See Consolidated Special Events Tab
Chicago Community Trust Draw	$0	$0	$225,000	Take 2016 + 2017 Draws
TOTAL INCOME:	**$1,167,500**	**$1,678,000**	**$1,769,500**	
EXPENSES:				
Board and Liaison	$16,000	$14,000	$14,000	Hold estimated 2016 level
Grants and Contracts	$450,000	$550,000	$350,000	Shifts $100K from 2017 to 2016 for PG&E/UAA Project
Occupancy and Equipment	$28,000	$23,000	$28,000	Full Year Higher Rent (2016 Had Moving Expenses)
Office Expense	$32,000	$28,000	$46,900	2016 Levels plus Campaign Materials
Personnel Expense	*$380,700*	*$360,000*	*$312,853*	*Added campaign staff cost shown under professional contract expense; depending on CCS*
Professional Contract Expense	*$25,000*	*$115,000*	*$150,500*	*recommendation(s), may go either way within this total pool of funding*
Service Fees	$12,000	$10,000	$10,000	Hold estimated 2016 level
Special Events: ISA Conference	$23,000	$23,000	$0	Now included in Tour; see Consolidated Special Events Tab
Special Events: Tour des Trees	$193,000	$220,000	$230,000	See Consolidated Special Events Tab; DC expenses to be high
Technology	$25,000	$20,000	$20,000	Hold estimated 2016 level
Travel and Meetings	$39,200	$30,000	$30,000	Hold estimated 2016 level
TOTAL EXPENSE:	**$1,223,900**	**$1,393,000**	**$1,192,253**	
PROFIT/(LOSS)	**($56,400)**	**$285,000**	**$577,247**	Operating and Endowment
TRANSFERS TO ENDOWMENT	**$0**	**$520,000**	**$565,000**	2016 Includes Transfer of Prior Year Funds, Reducing Excess Operating Surplus

CAMPAIGN CASH FLOW: 2017-2023

(Adjustments to the Campaign Value Recalculate Throughout Budget)

TOTAL CAMPAIGN VALUE: **$3,000,000** *<-- Note this is beyond UARF/PG&E Challenge; assumption is we get that done whether campaign or not*

PLEDGE PAYMENT YEARS (MAX) **4** *<-- Some will all be made at once, some in less, but conservative budget uses max time*

PLEDGES MADE

	2017	2018	2019	2020	2021	2022	2023
Pledge Percentage	42%	27%	18%	13%	0%	0%	0%
Pledge Value	$1,260,000	$810,000	$540,000	$390,000	$0	$0	$0

CASH COLLECTED (ALL TO ENDOWMENT; CAN'T DEFRAY EXPENSES)

	2017	2018	2019	2020	2021	2022	2023
2017 Pledge Payments	$315,000	$315,000	$315,000	$315,000	$0	$0	$0
2018 Pledge Payments	$0	$202,500	$202,500	$202,500	$202,500	$0	$0
2019 Pledge Payments	$0	$0	$135,000	$135,000	$135,000	$135,000	$0
2020 Pledge Payments	$0	$0	$0	$97,500	$97,500	$97,500	$97,500
TOTAL NEW FUNDING	**$315,000**	$517,500	$652,500	$750,000	$435,000	$232,500	$97,500
EXPECTED/PLEDGED UARF	**$250,000**	*<-- Does not include pledged 2017 funds booked as receivables in 2016*					
OTHER TEMP RESTRICTIONS	$100,000	*<-- Money that comes in and goes back out for grants/projects in same year*					
TOTAL 2017 RESTRICTED INCOME	**$665,000**						

CAMPAIGN EXPENSES (BASED ON 10% OF PLEDGE LEVEL)

	2017	2018	2019	2020	2021	2022
Cash Required Above Normal Ops	$126,000	$81,000	$54,000	$39,000	$0	$0
Composed of:						
Personnel	60%	60%	60%	60%	60%	60%
Production Materials	30%	30%	30%	30%	30%	30%
Office and Overhead	10%	10%	10%	10%	10%	10%
Dollar Value:						
Personnel (*)	**$75,600**	$48,600	$32,400	$23,400	$0	$0
Production Materials (**)	**$37,800**	$24,300	$16,200	$11,700	$0	$0
Office and Overhead	$12,600	$8,100	$5,400	$3,900	$0	$0

(*) 100% in Professional Fees, though may elect to add staff

(*) Split 50/50 Between Professional Fees (Design) and Office Expense (Production)

CONSOLIDATED SPECIAL EVENTS: TOUR AND ISA INT'L

	2016 Budget			2017 Budget
	Tour	ISA	Total	Consolidated
INCOME:				
Corporate Partnership (Incl. Chapters)	$315,500	$40,000	$355,500	$350,000
Registrations	$8,500	$5,000	$13,500	$14,000
Rider Fundraising (Operating Portion)	$245,000	$0	$245,000	$280,000
Auctions (Live, Silent, Raffles, Etc.)	$0	$25,000	$25,000	$30,000
Miscellaneous Sales (Merch, Hotel, Etc.)	$6,500	$0	$6,500	$11,000
TOTAL INCOME:	$575,500	$70,000	$645,500	$685,000

	2016 Budget			2017 Budget
	Tour	ISA	Total	Consolidated
EXPENSE:				
Tour Director Contract	$40,000	$0	$40,000	$50,000
Other Contracts	$6,000	$4,000	$10,000	$8,000
Team Lodging	$50,000	$2,500	$52,500	$54,000
Food Service (Catering or Meals)	$57,000	$7,000	$64,000	$64,000
Event-Specific Staff Travel	$6,000	$2,500	$8,500	$7,000
Merchandise Production	$10,000	$0	$10,000	$10,000
Other Printing and Production	$5,000	$4,000	$9,000	$9,000
Crowdrise Platform and Fees	$12,500	$0	$12,500	$18,500
Miscellaneous Expenses	$6,500	$3,000	$9,500	$9,500
TOTAL EXPENSE:	$193,000	$23,000	$216,000	$230,000

NET PROFIT/(LOSS)	$382,500	$47,000	$429,500	$455,000

Pursuant to the Board's approval of a $3.0 million fundraising campaign atop current operating and endowment building activities, the Finance Committee recommends the Board's approval of a 2017 operating budget containing the following key financial elements:

- *Total revenues of $1,769,500; which include $665,000 in permanently or temporarily restricted funds that directly support TREE Fund's programmatic mission;*

- *Total expenses of $1,192,253; which include $350,000 in new grant awards, to be issued atop all prior year awards payable in 2017 and beyond;*

- *Total investments in endowment funds of $565,000; funds raised for existing endowment lines will be invested at Chicago Community Trust (CCT); funds raised for new endowment lines will be reviewed and approved by the Board of Trustees before investment with CCT or other custodians as may be recommended by the President and CEO via the Finance Committee.*

RESTATED DECLARATION OF TRUST
OF
TREE RESEARCH & EDUCATION ENDOWMENT FUND

The International Society of Arboriculture Research Trust Declaration of Trust was made as of August 7, 1976 by the following named officers and representatives of the International Society of Arboriculture (hereinafter called ISA): Jack R. Rogers, President; Hyland R. Johns, Jr., President-Elect; Yvon Fournier, Vice President; E.B. Himelick, Executive Director; and John Z. Duling, Immediate Past President, who declared and agreed that they had received that day from the Research Fund of the ISA, as Donor, the sum of Ten Dollars ($10) and that they would hold and manage the same, and any additions to it, in trust, as hereinafter provided.

Pursuant to an agreement dated February 5, 2001 by and between the International Society of Arboriculture Research Trust (hereinafter called ISART) and the National Arborist Foundation, Inc. (hereinafter called NAF) a single entity was formed following dissolution of NAF in accordance with the laws of the State of New York. Attached is a copy of said Agreement, which is incorporated herein, and which provides in Paragraph 5 for a name change to reflect the purposes and recitals set forth in the Agreement, together with the Determination Letter from Internal Revenue issued on January 26, 1977 recognizing the Trust as tax-exempt under Internal Revenue Code 501(c)(3), and a confirmation issued by Internal Revenue Service on June 23, 2016, reflecting the name change. While that confirmation references TREE Fund-Tree Research & Education Endowment Fund, the correct name is Tree Research & Education Endowment Fund, hereinafter referred to in this Declaration of Trust by its acronym TREE Fund.

This Restated Declaration of Trust incorporates all of the various amendments made to said Declaration of Trust since the original Declaration of Trust was adopted on August 7, 1976.

ARTICLE I

This organization shall be called the "Tree Research & Education Endowment Fund" (TREE Fund).

ARTICLE II

The Trustees may receive and accept property, whether real, personal or mixed, by way of gift, bequest, or devise, from any person, firm, trust or corporation, to be held, administered, and disposed of in accordance with and pursuant to the provisions of this Declaration of Trust. However, no gift, bequest, or devise of any such property shall be received and accepted if it is conditioned or limited in such manner as to require the disposition of the income or its principal to any person or organization other than a "charitable organization" or for other than "charitable purposes" within the meaning of such terms as defined in Article III of this Declaration of Trust, or as shall, in the opinion of the Trustees, jeopardize the Federal income tax exemption of the Trust pursuant to 501(c)(3) of the Internal Revenue Code, as now in force or afterwards amended.

In accordance with this Article II, the Trust has accepted funds from the NAF, including the Robert Felix Memorial Fund, and will designate a budgetary line for the appropriate accounting and administration of the fund. It will be accepted as an endowment from which only investment earnings will be used to fund projects, scholarships and other appropriate educational endeavors as outlined in the Agreement attached hereto. For other funds donated

to the Trust, the Trustees may utilize income and principal in the Trustees' discretion unless limited by a written agreement with the donor, as specified in Article III D.

ARTICLE III

The purposes of this Trust are to devote and apply the property vested by this instrument in the Trustees and any income to be derived therefrom exclusively to those purposes or for the use of such organizations described below:

A. The principal and income of all property received and accepted by the Trustees to be administered under this Declaration of Trust shall be held in trust by them and used to further charitable, scientific and educational purposes, including but not limited to the following:

1) Provide a method to fund the acquisition of "state of the art" knowledge and education;

2) Encourage educational pursuits in the field of arboriculture and urban forestry;

3) Fund endeavors that will benefit the arborist profession in its efforts to protect and enhance global environments;

4) Identify and fund basic and applied research and educational projects concerning the significant environmental, biological, social and economic needs of arboriculture and urban forestry including tree genetics, management and care;

5) Provide scholarships for college students studying arboriculture as their field of choice; and

6) Develop endowments for scholarship and research;

all within the meaning of Section 170(c)(2) and Section 501(c)(3) of the Internal Revenue Code (or the corresponding provisions of any future United States Internal Revenue Law).

B. The Trustees may make payments or distributions from income or principal, or both, to or for the use of such charitable, scientific or educational organizations or directly for such charitable, scientific or educational purposes, and in such amounts as the Trustees shall from time to time select and determine, without making use of any other charitable organization, but limited to and including only charitable, scientific and educational purposes and organizations as defined in the above Paragraph A which come within the meaning of those terms used in Section 501(c)(3) and Section 170(c)(2)(B) and (C) of the Internal Revenue Code (or the corresponding provision of any future United States Internal Revenue Law), and only such purposes as also constitute public charitable purposes under the laws of trusts of the State of Illinois.

C. The Trustees may also make payments and distributions of the income or principal, or both, to the States, Territories or possessions of the United States, any political subdivision of any of the foregoing, or to the United States or the District of Columbia but only for the charitable, scientific and educational purposes as defined above in Paragraph A.

D. The Trustees may, at the discretion of a donor, designate portions of the principal donated by such donor, with the income only to be used for such charitable, scientific or educational organizations and purposes as are defined in the above Paragraph A.

E. The making of grants and contributions and otherwise rendering financial assistance for the purposes expressed in the above Paragraph A shall be within the exclusive powers of the Trustees. Requests for such funds may be

presented by the Research and Education Committee to the Trustees. The Trustees shall review all requests for funds and shall require that such requests specify the use to which the funds will be put, and if the Trustees approve the request, they shall authorize payment to the approved grantee. The Trustees shall require that the grantee furnish a periodic accounting to show that the funds were expended for the purposes which were approved by the Trustees. The Trustees shall review such periodic accounting.

F. In this Declaration of Trust and in any amendments to it, references to "charitable organizations" or "charitable organization" mean corporations, trusts, funds, foundations, or community chests created or organized in the United States or in any of its possessions, whether under the laws of the United States, any state or territory, the District of Columbia, or any possession of the United States, organized and operated exclusively for charitable purposes, no part of the net earnings of which inures or is payable to or for the benefit of any private shareholder or individual, and no substantial part of the activities of which is carrying propaganda, or otherwise attempting to influence legislation, and which do not participate in or intervene in (including the publishing or distributing of statements) any political campaign on behalf of or in opposition to any candidate for public office. It is intended that the organization described in this paragraph F shall be entitled to exemption from federal income tax under Section 501(c)(3) of the Internal Revenue Code, or the corresponding section of any future federal tax code.

ARTICLE IV

The Trust shall continue forever unless the Trustees terminate it and distribute all of the principal and income, which action may be taken by the Trustees at their discretion at any time. On such termination, the Trustees, after making provision for the payment of all liabilities of the Trust, shall dispose of all the assets of the Trust Fund as then constituted, exclusively for charitable purposes similar to those of the fund itself or to such charitable organization or organizations, as the Trustees shall determine, which are organized and operated exclusively for such charitable purposes as shall at the time (a) qualify as exempt under Section 501(c)(3) of the Internal Revenue Code (or the corresponding provision of any future United States Revenue Law) and (b) contributions to which are deductible under Section 170(c)(2) of the Internal Revenue Code (or the corresponding provision of any future United States Internal Revenue Law). The donor authorizes and empowers the Trustees to form and organize a non-profit corporation limited to the uses and purposes provided for in this Declaration of Trust, such corporation to be organized under the laws of any state or under the laws of the United States as may be determined by the Trustees, such corporation when originated to have power to administer and control the affairs and property and to carry out the uses, objects, and purposes of the Trust. Upon the creation and organization of such corporation, the Trustees are authorized and empowered to convey, transfer and deliver to such corporation all the property and assets to which this Trust may be or become entitled. The charter, bylaws, and other provisions for the organization and management of such corporation and its affairs and property shall be such as the Trustees shall determine, consistent with the provisions of this paragraph. However, funds designated as the Robert Felix Memorial Fund must be distributed

to a charitable or educational organization consistent with a recommendation by the National Arborist Association, Inc. (hereinafter called NAA) or its successor in interest, if any such successor exists, and, if not, then as otherwise provided for in this Agreement.

ARTICLE V

This Declaration of Trust may be amended at any time or times by written instrument or instruments signed and sealed by the Trustees, and acknowledged by any of the Trustees, provided that no amendment shall authorize the Trustees to conduct the affairs of this Trust in any manner or for any purposes contrary to the provisions of Section 501(c)(3) of the Internal Revenue Code as now in force or afterwards amended. An amendment(s) of the provisions of this Article V (or any amendment to it) shall be valid only if and to the extent that such amendment further restricts the Trustees' amending power. All instruments amending this Declaration of Trust shall be noted or kept attached to the executed original of this Declaration of Trust held by the Trustees.

ARTICLE VI

The Trustees shall be appointed in the following manner:

A. The Trustees under this Declaration of Trust shall be the Chairman of the ISA TREE Fund Chapter liaison committee and eleven (11) to fourteen (14) other members. Trustees' terms will be for two (2) years. The Governance Committee shall recommend to the Board of Trustees names of persons to fill Trustee vacancies and the Board shall thereupon fill such vacancies by majority vote. An appointed Trustee can succeed him/herself as a Trustee. However, Trustees are limited to three full consecutive two (2) year terms, except under special conditions as approved by the Board of Trustees, and provided that after

a one year absence from the Board of Trustees, an individual shall again be eligible to serve. Trustees shall serve until their successors have been appointed and have duly accepted the office. Any Trustee under this Declaration of Trust may, by written instrument, signed, acknowledged and delivered to each other Trustee, resign his/her office effective upon completion of such delivery. The number of Trustees shall at all times be not less than eleven (11) and whenever for any reason the number is reduced to ten (10), there shall be, and at any other time there may be, appointed one or more additional Trustees. An appointment to fill an unexpired term shall be recommended by the Governance Committee and approved by a majority vote of the Board of Trustees. Any succeeding or additional Trustee shall, upon his/her acceptance of the office by written instrument signed, acknowledged, and delivered have the same powers, rights, and duties, and the same title to the trust estate jointly with the Trustees as if originally appointed. The TREE Fund Office shall maintain a complete and current record of all past and present Trustees, including all documentation of acceptances, appointments and resignations.

B. None of the Trustees shall be required to furnish any bond or surety. None of them shall be responsible or liable for the acts or omission of any other of the Trustees or of any predecessor or of a custodian, agent, depositary or counsel selected with reasonable care.

C. The one or more Trustees, whether original or successor, for the time being in office, shall have full authority to act even though one or more vacancies may exist. A Trustee may, by appropriate written instrument, delivered to each of

the other Trustees, delegate all or any part of his powers to another or others of the Trustees for such periods and subject to such conditions as such delegating Trustee may determine.

D. The Trustees serving under this Declaration of Trust are authorized to pay to themselves amounts for reasonable expenses incurred in the administration of this Trust, if not otherwise reimbursed by the Trustee's employer or other agency, if deemed necessary due to extenuating circumstances.

E. The Trustees shall take office January 1. The Trustees shall select a Chairman, Chairman-Elect, Vice Chairman and Secretary-Treasurer to serve for one (1) year. The Executive Committee will include the Chairman, Chairman-Elect, Vice Chairman and Secretary-Treasurer. The Trustees shall meet at least two (2) times each year. A majority of Trustees shall constitute a quorum. Action may be taken by a majority vote of those Trustees constituting the quorum. Action may also be taken by mail ballot; e-mail ballot; or a quorum gathered by conference call, by a majority vote of all the Trustees. The Trustees shall be required to keep minutes of their meetings and any actions taken by mail ballot and e-mail ballot.

F. The following standing committees will be established: Governance, Research and Education, Finance, Audit, Development and Communications and ISA Chapter Liaisons. Committees shall be appointed by the Executive Committee and must be chaired by a Trustee appointed by the Executive Committee.

G. The Board of Trustees shall appoint a President/CEO who will report to the Executive Committee, and shall be an Ex Officio, non-voting member of the

Board of Trustees. Such President/CEO, as an Ex Officio, non-voting member of the Board of Trustees, shall not count toward the 15 member cap for the Board of Trustees, nor shall any other Ex Officio, non-voting member, nor any emeritus Trustee count toward said cap.

ARTICLE VII

In extension and not in limitation of the common law and statutory powers of Trustees and other powers granted in this Declaration of Trust, the Trustees shall have the following discretionary powers:

A. To invest and reinvest the principal and income of the trust in such property, real, personal, or mixed, and in such manner as they shall deem proper, and from time to time to change investments as they shall deem advisable; to invest in or retain any stocks, shares, bonds, notes, obligations, or personal or real property (including without limitation any interests in or obligations of any corporation, association, business trust, investment trust, common trust fund, or investment company) although some or all of the property so acquired or retained is of a kind or size which but for this express authority would not be considered proper and although all of the trust funds are invested in the securities of one company. No principal or income, however, shall be loaned, directly or indirectly, to any Trustee or to anyone else, corporate or otherwise, who has at any time made a contribution to this Trust, nor to anyone except on the basis of an adequate interest charge and with adequate security.

B. To sell, lease or exchange any personal, mixed or real property, at public auction, or by private contract, for such consideration and on such terms as to

credit or otherwise, and to make such contracts and enter into such undertakings relating to the Trust property, as they consider advisable, whether or not such leases or contracts may extend beyond the duration of the Trust.

C. To borrow money for such periods, at such rates of interest, and upon such terms as the Trustees consider advisable, and as security for such loans to mortgage or pledge any real or personal property with or without power of sale; to acquire or hold any real or personal property, subject to any mortgage of pledge on or of property acquired or held by this Trust.

D. To execute and deliver deeds, assignments, transfers, mortgages, pledges, leases, covenants, contracts, promissory notes, releases, and other instruments, sealed or unsealed, incident to any transaction in which they engage.

E. To vote, to give proxies, to participate in the reorganization, merger or consolidation of any concern, or in the sale, lease, disposition or distribution of its assets; to join with other security holders in acting through a committee, depositary, voting trustees, or otherwise, and in this connection to delegate authority to such committee, depositary, or trustees and to deposit securities with them or transfer securities to them, to pay assessments levied on securities, or to exercise subscription rights in respect of securities.

F. To employ a bank or trust company as custodian of any funds or securities and to delegate to it such powers a they deem appropriate; to hold Trust property without indication of fiduciary capacity but only in the name of a registered nominee, provided the trust property is at all times identified as such on the books of the Trust; to keep any or all of the Trust property or funds in any place

or places in the United States of America; to employ clerks, an administrator, accountants, investment counsel, investment agents, and any special services, and to pay the reasonable compensation and expenses of all such services.

ARTICLE VIII

The Trustees' powers are exercisable solely in the fiduciary capacity consistent with and in furtherance of the charitable purposes of this Trust as specified in Article III and not otherwise.

ARTICLE IX

In this Declaration of Trust and in any amendment to it references to "Trustees" mean the one or more Trustees, whether original or successor, for the time being in office.

ARTICLE X

Any person may rely on a copy, certified by a notary public, or the executed original of this Declaration of Trust held by the Trustees, and of any of the notations on it and writings attached to it, as fully as he might rely on the original documents themselves. Any such person may rely fully on any statements of fact certified by anyone who appears from such original documents or from such certified copy of be a Trustee under this Declaration of Trust. No one dealing with the Trustees need inquire concerning the validity of anything the Trustees purport to do. No one dealing with the Trustees need see to the application of anything paid or transferred to or upon the order of the Trustees of the Trust.

ARTICLE XI

This Declaration of Trust is to be governed in all respects by the laws of the State of Illinois.

ARTICLE XII

Any Trustee, Officer, Employee or Committee member having an interest in a contract or other transaction presented to the Board of Trustees or a Committee thereof for authorization, approval, or ratification shall give prompt, full, and frank disclosure of his/her interest to the Board or Committee prior to its acting of such contract or transaction. The body to which such disclosure is made shall thereupon determine, by majority vote, whether the disclosure shows that a conflict of interest exists or can reasonably be construed to exist. If a conflict is deemed to exist, such person shall not vote on, nor use his personal influence on, nor participate (other than to present factual information or to respond to questions) in the discussions or deliberations with respect to such contract or transactions. Such person may be counted in determining the existence of a quorum at any meeting where the contract or transaction is under discussion or is being voted upon. The minutes of the meeting shall reflect the disclosure made, the vote thereon, and, where applicable, the abstention from voting and participation, and whether a quorum is present.

ARTICLE XIII

Any and all Officers, members of the Executive Committee, members of the Board of Trustees, former Officers, former members of the Board of Trustees, former members of the Board of Directors, former members of the Executive Committee of TREE Fund and any person who may have served at its or their request shall be indemnified by the Trust against expenses (including attorney's fees), judgments, fines, and amounts paid in settlement actually and necessarily incurred by them in connection with the defense or settlement of any action, suit or proceeding in which they, or any of them, are made parties, or a party, by reason of

being or having been a Trustee, Director, Officer, Board Member, or Executive Committee member or person who served at the request of any of the foregoing for the benefit of TREE Fund, except in relation to matters as to which any such Trustee, Director, Officer, former Trustee, former Director, former Officer, former Executive Committee member, or person shall be adjudged in such action, suit, or proceeding to be liable for willful misconduct in the performance of duty and as to such matters as shall be settled by agreement predicated on the existence of such liability. The indemnification provided hereunder shall inure to the benefit of the heirs and personal representatives of the persons entitled to indemnification hereunder. This right of indemnification shall be in addition to and not exclusive of any other rights to which any person may be entitled.

AGREEMENT
BETWEEN THE NATIONAL ARBORIST FOUNDATION, INC. AND THE INTERNATIONAL SOCIETY OF ARBORICULTURE RESEARCH TRUST AND PLAN OF DISSOLUTION AND DISTRIBUTION OF ASSETS OF THE NATIONAL ARBORIST FOUNDATION, INC.

The following sets forth the terms of an Agreement between The National Arborist Foundation, Inc., 3 Perimeter Road, Unit 1, Manchester, New Hampshire 03103, a not-for-profit corporation organized in and governed by the laws of the state of New York ("NAF"), and the International Society of Arboriculture Research Trust, P. O. Box 3129, Champaign, Illinois 61826, a trust organized in and governed by the laws of the state of Illinois ("ISART").

WHEREAS, NAF and ISART have determined that the purposes of the organizations are consistent;

WHEREAS, the parties have determined that the purposes for which the organizations were organized will be furthered by centralizing the resources and operations of the organizations;

WHEREAS, NAF is desirous of winding up its financial affairs, but continuing a presence in an integrated manner under ISART;

NOW, THEREFORE, NAF and ISART hereby agree as follows:

1. NAF will dissolve in accordance with the laws of the state of New York and in accordance with the laws of any other state in which it is registered to do business.

2. NAF will transfer all of its assets to ISART and wind up all of its business.

3. NAF will provide ISART satisfactory proof of the complete and proper dissolution and winding up of its affairs, including without limitation, opinions from its auditors and legal counsel that the dissolution of NAF is complete, and an affidavit of satisfaction of liabilities affirming that there are no existing or contingent liabilities which could be asserted against ISART.

4. ISART shall accept the assets of NAF, including, without limitation, monetary funds or the equivalent thereof to be used exclusively for charitable, scientific and educational purposes consistent with the ISART Trust Agreement, Section 501(c)(3) of the United States Internal Revenue Code and Section 170(c)(2) of the United States Internal Revenue Code, as amended from time to time.

5. Pursuant to Article VI of the International Society of Arboriculture Research Trust Agreement ("Trust Agreement"), IRART shall change the name of the Trust to reflect the purposes and recitals set forth in this Agreement.

6. At the first meeting of the Board of Trustees of the ISART after the execution of this Agreement, and consistent with Article VII of the Trust Agreement, the composition of the Board of Trustees of ISART will be changed to include all of the existing board members of ISART and all of the existing board members of the former NAF. In addition, two members of the Board of Trustees shall be appointed by the National Arborist Association ("NAA") and two members shall be appointed by the International Society of Arboriculture ("ISA"). One of the members appointed by each organization shall be a member of that organization's board of directors. The chairman of the Liaison Committee shall also be a member of the Board of Trustees.

7. There will be an executive committee of ISART formed to include the President, Vice President, Secretary-Treasurer, the Board of Trustees member who serves on the board by appointment by the ISA board of directors, and the Board of Trustees member who serves on the board by appointment by the NAA board of directors.

8. ISART shall receive any such assets and accept such property consistent with Article II of the Trust Agreement which requires disposition of income or principal only for charitable, scientific, or educational purposes as set forth therein.

9. In the event of and upon receipt of funds from the NAF Robert Felix Memorial Fund, ISART shall amend the Trust Agreement to describe the purposes of the Fund and shall designate a budgetary line for the appropriate accounting and administration of that Fund.

10. The Trust Agreement shall provide that a Robert Felix Memorial Fund is an endowment from which only investment earnings may be used to fund projects, scholarships and other appropriate educational endeavors.

11. The Trust Agreement and operation of ISART shall be amended as appropriate to create a committee to make recommendations concerning expenditures from the Robert Felix Memorial Fund. The committee will include members of the Robert Felix family or persons designated by the Robert Felix family will make recommendations to the Trust for the disbursement of the earnings from the Robert Felix Memorial Fund, it being understood that it would be a violation of the Trust Agreement to allow non-trustees to control the administration and disposition of any funds from the Trust, and that any such violation could jeopardize the status of ISART under Section 501(c)(3) of the United States Internal Revenue Code, as amended from time to time. In its consideration of disbursements from the Fund, the committee will use the guidelines stated in a letter from Patricia Felix dated November 11, 2000, a copy of which is attached to this Agreement as Exhibit A.

12. ISART will continue to be located in Champaign, Illinois or such other place as the Trustees may designate.

13. In the event of the dissolution of ISART, its funds will be distributed in accordance with the dissolution provisions of the Trust Agreement; provided, however, that the funds designated as the Robert Felix Memorial Fund shall be distributed to a charitable or educational organization consistent with a recommendation by the National Arborist Association, Inc. or its successor in interest, if any such successor exists, and, if not, then as otherwise provided for in the Trust Agreement.

14. It will be the purpose of ISART to provide a method to fund the acquisition of "state of the art" knowledge and education, and to encourage educational pursuits in the field of arboriculture and urban forestry that will benefit commercial arborists and individual professionals in the field of arboriculture.

15. The goals of ISART will be modified as applicable, appropriate and feasible to include the following:

A. fund endeavors that will benefit the commercial arborist profession in its efforts to protect and enhance global environments;

B. identify and fund basic and applied research and educational projects concerning the significant environmental, biological, social and economic needs of arboriculture and urban forestry including tree genetics, management and care;

C. provide scholarships for college students studying arboriculture as their field of choice; and

D. develop endowments for scholarship and research.

Donors will be provided an opportunity to designate their contributions to support specific projects established by the ISART to benefit commercial arboriculture.

16. The Trust Agreement shall be amended, and bylaws shall be developed which are consistent with the Trust Agreement, and operationally pertinent provisions of the Plan for Arboriculture Trust/Foundation, and the purposes of arboricultural organizations, the National Arborist Association and the International Society of Arboriculture, which will provide funding and other support to the Trust, for time to time.

IN WITNESS WHEREOF, this Agreement is approved by the ISART Board of Trustees and the Board of Directors of the NAF and the parties have caused this Agreement to be executed by their authorized representatives.

INTERNATIONAL SOCIETY OF ARBORICULTURE RESEARCH TRUST

BY: _____
Allan J. West, Chair

2/5/01
Date

NATIONAL ARBORIST FOUNDATION, INC.

BY: _____
Jerry Morey, Chairman

2/1/01
Date

RECEIVED JAN 3 1 1977

Address any reply to: 1114 Market St., St. Louis, Mo. 63101

Department of the Treasury

District Director

Internal Revenue Service

Date: JAN 2 6 1977

In reply refer to: EP/EO:7206:W. Bosch
314-425-5651

StL:EO:77:76

International Society of Arboriculture
Memorial Research Trust
P.O. Box 71
North 3 Lincoln Square
Urbana, Illinois 61801

Gentlemen:

Accounting Period Ending: December 31
Form 990 Required: ☒ Yes ☐ No
Advance Ruling Period Ends: December 31, 1978

Based on the information supplied, and assuming your operations will be as stated in your application for recognition of exemption, we have determined you are exempt from Federal income tax under section 501(c)(3) of the Internal Revenue Code.

Because you are a newly created organization, we are not now making a final determination of your foundation status under section 509(a) of the Code. However, we have determined that you can reasonably be expected to be a publicly supported organization of the type described in section 170(b)(1)(A)(vi) and 509(a)(1).

Accordingly, you will be treated as a publicly supported organization, and not as a private foundation, during an advance ruling period. This advance ruling period begins on the date of your inception and ends on the date shown above.

Within 90 days after the end of your advance ruling period, you must submit to us information needed to determine whether you have met the requirements of the applicable support test during the advance ruling period. If you establish that you have been a publicly supported organization, you will be classified as a section 509(a)(1) or 509(a)(2) organization so long as you continue to meet the requirements of the applicable support test. If, however, you do not meet the public support requirements during the advance ruling period, you will be classified as a private foundation for future periods. Also, in the event you are classified as a private foundation, you will be treated as a private foundation from the date of your inception for purposes of sections 507(d) and 4940.

Grantors and donors may rely on the determination that you are not a private foundation until 90 days after the end of your advance ruling period. In addition, if you submit the required information

within the 90 days, grantors and donors may continue to rely on the advance determination until the Service makes a final determination of your foundation status. However, if notice that you will no longer be treated as a section 509(a)(1) organization is published in the Internal Revenue Bulletin, grantors and donors may not rely on this determination after the date of such publication. Also, a grantor or donor may not rely on this determination if he was in part responsible for, or was aware of, the act or failure to act that resulted in your loss of section 509(a)(1) status, or acquired knowledge that the Internal Revenue Service had given notice that you would be removed from classification as a section 509(a)(1) organization.

Donors may deduct contributions to you as provided in section 170 of the Code. Bequests, legacies, devises, transfers, or gifts to you or for your use are deductible for Federal estate and gift tax purposes if they meet the applicable provisions of sections 2055, 2106, and 2522 of the Code.

You are not liable for social security (FICA) taxes unless you file a waiver of exemption certificate as provided in the Federal Insurance Contributions Act. You are not liable for the taxes imposed under the Federal Unemployment Tax Act (FUTA).

Organizations that are not private foundations are not subject to the excise taxes under Chapter 42 of the Code. However, you are not automatically exempt from other Federal excise taxes. If you have any questions concerning these taxes, please let us know.

If your sources of support, or your purposes, character, or method of operation is changed, you should let us know so we can consider the effect of the change on your status. Also, you should inform us of all changes in your name or address.

If the yes box at the top of this letter is checked, you are required to file Form 990, Return of Organization Exempt From Income Tax, only if your gross receipts each year are normally more than $5,000. The return is due by the 15th day of the fifth month after the end of your annual accounting period. The law imposes a penalty of $10 a day, up to a maximum of $5,000, for failure to file the return on time.

You are not required to file Federal income tax returns unless you are subject to the tax on unrelated business income under section 511 of the Code. If you are subject to this tax, you must file an income tax return on Form 990-T. In this letter we are not determining whether any of your present or proposed activities are unrelated trade or business as defined in section 513 of the Code.

You need an employer identification number even if you have no employees. If an employer identification number was not entered on your application, a number will be assigned to you and you will be advised of it. Please use that number on all returns you file and in all correspondence with the Internal Revenue Service.

Sincerely yours,

District Director

IRS Department of the Treasury
Internal Revenue Service

CINCINNATI OH 45999-0038

In reply refer to: 0248222025
June 23, 2016 LTR 4168C 0
37-1018692 000000 00
Input Op: 0248222025 00024871
BODC: TE

TREE FUND-TREE RESEARCH & EDUCATION
ENDOWMENT FUND
% M JANET BORNANCIN
552 S WASHINGTON ST STE 109
NAPERVILLE IL 60540-6669

035844

Employer ID Number: 37-1018692
Form 990 required: yes

Dear Taxpayer:

This is in response to your request dated June 14, 2016, regarding your tax-exempt status.

We issued you a determination letter in January 1977, recognizing you as tax-exempt under Internal Revenue Code (IRC) Section 501(c)(3).

Our records also indicate you're not a private foundation as defined under IRC Section 509(a) because you're described in IRC Sections 509(a)(1) and 170(b)(1)(A)(vi).

Donors can deduct contributions they make to you as provided in IRC Section 170. You're also qualified to receive tax deductible bequests, legacies, devises, transfers, or gifts under IRC Sections 2055, 2106, and 2522.

In the heading of this letter, we indicated whether you must file an annual information return. If a return is required, you must file Form 990, 990-EZ, 990-N, or 990-PF by the 15th day of the fifth month after the end of your annual accounting period. IRC Section 6033(j) provides that, if you don't file a required annual information return or notice for three consecutive years, your exempt status will be automatically revoked on the filing due date of the third required return or notice.

For tax forms, instructions, and publications, visit www.irs.gov or call 1-800-TAX-FORM (1-800-829-3676).

If you have questions, call 1-877-829-5500 between 8 a.m. and 5 p.m., local time, Monday through Friday (Alaska and Hawaii follow Pacific Time).

0248222025
June 23, 2016 LTR 4168C 0
37-1018692 000000 00
Input Op: 0248222025 00024872

TREE FUND-TREE RESEARCH & EDUCATION
ENDOWMENT FUND
% M JANET BORNANCIN
552 S WASHINGTON ST STE 109
NAPERVILLE IL 60540-6669

Sincerely yours,

Doris P. Kenwright

Doris Kenwright, Operation Mgr.
Accounts Management Operations 1

User: amberland@bsu.edu

Save Draft

ADMIN: Reason(s) Not Eligible

John Z. Duling Grant Application

Please note: This application may only be submitted July 1 - October 1.

If you have any questions, please email bduke@treefund.org or call 630-369-8300 x200.

Applicant

Principal Investigator

Prefix	Dr.
First name	Adam
Last name	Berland
Status	Professor
Title	Assistant Professor of Geography
Organization	Ball State University
Mailing address	2000 W. University Ave
Mailing address line 2	CL 425
City	Muncie
State/province	Indiana
Zip/post code	47306
Country	United States
Email address	amberland@bsu.edu

Phone number	+1-765-285-1334
Degrees	Ph.D., Geography, University of Minnesota, 2012 M.A., Geography, University of Minnesota, 2007 B.A., Geography & Environmental Studies, University of St. Thomas (MN), 2005
Relevant citations authored	1. BERLAND A, Lange DA, in revision. Google Street View shows promise for virtual street tree surveys. Urban Forestry & Urban Greening. 2. BERLAND A, Shiflett SA, Shuster WD, Garmestani AS, Herrmann DL, Goddard HC, Hopton ME, in revision. The role of trees in urban stormwater management. Landscape and Urban Planning. 3. BERLAND A, Herrmann DL, Hopton, ME. 2016. National assessment of Tree City USA participation according to geography and socioeconomic characteristics. Arboriculture & Urban Forestry 42: 120-130. 4. BERLAND A, Hopton ME. 2016. Asian longhorned beetle complicates the relationship between taxonomic diversity and pest vulnerability in street tree assemblages. Arboricultural Journal 38: 28-40. 5. Green OO, Garmestani AS, Albro S, Ban NC, BERLAND A, Burkman CE, Gardiner MM, Gunderson L, Hopton ME, Schoon ML, Shuster WD. 2016. Adaptive governance to promote ecosystem services in urban green spaces. Urban Ecosystems 19: 77-93. 6. BERLAND A, Schwarz K, Herrmann DL, Hopton ME. 2015. How environmental justice patterns are shaped by place: terrain and tree canopy in Cincinnati, Ohio, USA. Cities and the Environment (CATE) 8(1): Article 1. 7. BERLAND A, Elliott GP. 2014. Unexpected connections between residential urban forest diversity and vulnerability to two invasive beetles. Landscape Ecology 29: 141-152. 8. BERLAND A, Hopton ME. 2014. Comparing street tree assemblages and associated stormwater benefits among communities in metropolitan Cincinnati, Ohio, USA. Urban Forestry & Urban Greening 13: 734-741. 9. BERLAND A, Manson SM. 2013. Patterns in residential urban forest structure along a synthetic urbanization gradient. Annals of the Association of American Geographers 103: 749-763. 10. BERLAND A. 2012. Long-term urbanization effects on tree canopy cover along an urban–rural gradient. Urban Ecosystems 15: 721-738.
Has this investigator previously received funding from the TREE Fund?	No
If yes, was the funding for this project?	No
Previous TREE Fund awards	

Co-Principal Investigator (if applicable)

Prefix	Dr.
First name	Jess
Last name	Vogt
Status	Professor
Title	Assistant Professor of Environmental Science and Studies
Organization	DePaul University
Mailing address	EVN Dept., McGowan South
Mailing address line 2	1110 W Belden Ave
City	Chicago
State/province	Illinois
Zip/post code	60614
Country	United States
Email address	jessica.m.vogt@gmail.com
Phone number	+1-920-850-2016
Degrees	Ph.D., Environmental Science, Indiana University, 2014 M.S., Environmental Science, Indiana University, 2012 Master of Public Affairs, Indiana University, 2012 B.A., Biology & Environmental Studies, Lawrence University, 2009
Relevant citations authored	1. Watkins SL, Mincey SK, VOGT J, Sweeney SS. 2016. Is planting equitable? An examination of the spatial distribution of nonprofit urban street tree planting programs by canopy cover, income, race, and ethnicity. Environment and Behavior. In press. DOI: 10.1177/0013916516636423. 2. Widney SE, Fischer BC, VOGT J. 2016. Tree mortality undercuts ability of tree-planting programs to provide benefits: Results of a three-city study. Forests 7(3): 65. 3. VOGT JM, Fischer BC, Hauer RJ. 2016. Urban forestry and arboriculture as interdisciplinary environmental science: Importance and incorporation of other disciplines. Journal of Environmental Studies and Sciences 6:371-386. 4. VOGT J, Watkins SL, Widney S, Fischer BC. 2015. Comparing trees across cities and over time: The need to standardize at-planting data. Arborist News 24(6): 27-31. 5. VOGT JM, Hauer RJ, Fischer BC. 2015. The costs of maintaining and not maintaining the urban forest: A review of the urban forestry and arboriculture literature. Arboriculture & Urban Forestry 41: 293-323. 6. VOGT JM, Watkins SL, Mincey SK, Patterson M, Fischer BC. 2015. Explaining planted-tree survival and growth in urban neighborhoods: A study of recently-planted trees in Indianapolis. Landscape & Urban Planning 136: 130-143. 7. VOGT JM, Epstein G, Mincey SK, Fischer BC, McCord P. 2015. Putting the “E” in SES: Unpacking the ecology in the social-ecological systems framework. Ecology & Society 20: 55. 8. VOGT JM, Fischer BC. 2014. A protocol for citizen science

	monitoring of urban trees. Cities and the Environment 7(2): Article 4. 9. Mincey SK, VOGT JM. 2014. Watering strategy, collective action, and neighborhood-planted trees: An Indianapolis case study. Arboriculture & Urban Forestry 40: 84-95.
Has this investigator previously received funding from the TREE Fund?	No
If yes, was the funding for this project?	
Previous TREE Fund awards	

Students/Interns (if applicable)

Student/Intern 1

Name	To be identified
Department or major	Environmental Science
Status	Undergraduate student

Student/Intern 2

Name	To be identified
Department or major	Environmental Science
Status	Undergraduate student

Student/Intern 3

Name	
Department or major	
Status	

Project

Project title	Evaluating virtual street tree surveys as a tool for municipal forest management
Research area	Urban forestry
Project summary	Street tree inventories are critical to municipal forest management, but many communities cannot afford to conduct field-based inventories. It is possible to characterize street trees by manually interpreting images in Google Street View, which offers a free and user-friendly platform for accessing ground-level photographs taken along roads throughout the USA. We previously conducted a proof-of-concept study demonstrating that a ‘virtual survey’ in Street View

can produce reasonably accurate data about street tree variables relevant to municipal management such as tree abundance, genus, and size class. However, that virtual survey was conducted by a single analyst with expertise in urban forest inventories, so we do not know how well this approach can be carried out by less experienced municipal staff or citizen scientists.

This project will build upon existing research to improve our understanding of the possibilities and limitations of conducting virtual street tree surveys in Google Street View. We will enlist analysts ranging from experts to novices to conduct virtual surveys to record basic tree attributes, and their performance will be evaluated against field data from the same set of streets. We are primarily interested in determining (1) what overall level of data quality can be generated using a virtual survey approach as compared to field surveys; and (2) how data quality varies according to the analyst's level of expertise, and whether citizen scientists can generate reliable data for management purposes. Our results will provide guidance for communities considering implementing this innovative approach for generating street tree inventory data.

Statement of problem

In recent decades, researchers and practitioners have prioritized the quantification of urban forest structure, function, and value. A better understanding of urban forest resources improves our ability to manage urban trees and justify expenditures on tree planting and care. Much of this work has focused on street trees, which are on the front lines of management and stewardship (Fischer & Steed, 2008). Street trees have numerous benefits including reduced energy use and stormwater runoff (McPherson et al., 2005), increased property values (Donovan & Butry, 2010), enhanced civic engagement (Fisher et al., 2015), and aesthetic enhancements promoting livable, walkable cities (Southworth, 2005). Data-driven management of street trees is vital to sustainable urban forests (Clark et al., 1997). Unfortunately, field data collection is expensive and time-consuming.

Street tree inventories have primarily relied on field work conducted by municipal foresters, consulting arborists, and student interns. Field surveys require substantial commitments of time, labor, and transportation, making them prohibitively expensive for many communities. While field surveys by professionals remain common (e.g., Östberg et al., 2013), there are a growing number of alternative techniques. For example, remote sensing approaches fusing LiDAR data and hyperspectral imagery can generate high-quality data (Alonzo et al., 2016). However, these techniques rely on expensive datasets, specialized software, and technical expertise that is out of reach for all but a select few communities. This is a concern for smaller cities and underserved communities that do not have the means to generate street tree data using field surveys or cutting edge remote sensing approaches.

We propose a new approach to street tree inventories that can make datasets more attainable for communities with limited resources: a 'virtual survey' using Google Street View. This imagery is freely

available and accessible for even novice computer users. Google Street View offers ground-level, panoramic photography along streets in most urban areas within the USA. Given that Street View allows a user to see a streetscape from the perspective of a car driving on that street, analysts can manually interpret the imagery to generate street tree data. There are several appealing features of virtual surveys: they can be conducted year-round using leaf-on Street View images (i.e., not limited to the summer field season); they can be repeated quickly in subsequent years to generate information about tree mortality and other population changes; and they use a free and publicly available online interface. Our previous research shows that an analyst with expertise in field botany can produce high-quality data from a virtual survey (Berland and Lange, in revision). There is potential for crowdsourcing virtual surveys, but it is unknown how data quality will differ among analysts with varying levels of expertise.

This research will address two key problems impeding the use of virtual street tree surveys in everyday urban forest management. First, can a virtual survey produce data of high enough quality to be useful for purposes of municipal street tree management? Second, what level of expertise is needed for an analyst to produce quality data?

REFERENCES: See attached list.

Significance of your proposed project as it relates to the profession of arboriculture or urban forestry

While virtual survey data cannot replace on-the-ground expert assessment to identify pruning needs or pest infestations, virtual survey data can complement field data by producing basic tree information more quickly. Based on our pilot study (Berland and Lange, in revision), virtual surveying can generate reasonably accurate data regarding tree locations, abundances, size classes, and taxonomic identification. In some states, such baseline data are a prerequisite to seeking additional funding for municipal forest management. This is particularly important for underserved communities that are interested in proactive urban forest management, but may not have the resources to fund a field inventory.

This project will break new ground in assessing the reliability of street tree data generated using virtual surveys in Google Street View, in particular by examining the quality of data produced by analysts ranging from experts to citizen scientists. Our project will provide research-based guidance about the expected quality of tree variables that can be collected via virtual surveys. In addition, we will compare virtual survey data to field data to document the accuracy of data produced by analysts with varying levels of expertise. These research outcomes will help communities determine whether a virtual survey is right for them, and whether it should be conducted by experts or citizens scientists. Potential applications include city arborists using virtual surveys to update street tree inventories during winter months, and leveraging volunteers or interns to produce a complete virtual survey of street trees where none exists.

REFERENCES: See attached list.

Description of what is currently known about proposed project area

OVERVIEW. The proposed project will evaluate the quality of street tree data generated using virtual surveys in Google Street View, and we will compare the performance of experts and citizen scientists with respect to data quality. Below we briefly summarize existing literature on street trees, research applications of Google Street View, and citizen science in urban forestry.

STREET TREES. Street trees are trees growing in the public right-of-way along streets. In many cities, streets trees are the most abundant and widely distributed trees managed by the municipality. Street trees provide an array of environmental, economic, and social benefits that have received increased attention since the 1990s (Mullaney et al., 2015). Sustainable management of street trees is needed to maintain the provision of these benefits (Clark et al., 1997), but this is difficult because street trees face challenges such as harsh growing conditions, conflicts with urban infrastructure, and destructive invasive pests (Mullaney et al., 2015). An up-to-date street tree inventory is a primary need for prudent management of street trees (Cowett and Bassuk, 2014). Street tree inventories contain information including tree locations, species, sizes, and health condition. An inventory can guide tree planting, pruning and other maintenance, removals, and responses to pest outbreaks. Unfortunately, collecting field data to generate a street tree inventory is too expensive and labor-intensive for many communities. After a field inventory is completed, it may quickly become outdated in a dynamic urban landscape. Repeated inventories that enable analysis of mortality and other aspects of population change are valuable but particularly rare (Roman et al., 2013, 2014).

EMERGING INVENTORY TECHNIQUES. Researchers are developing techniques to generate data about urban trees using remotely sensed imagery and LiDAR (O'Neil-Dunne et al., 2014; Alonzo et al., 2016). This is promising because it eliminates much of the time-consuming field work involved with street tree inventories. But these methods require expensive imagery products and highly specialized computer software, putting these techniques out of reach for most communities. On the other hand, Google Street View is freely and publicly available, easy to use, and offers ground-level panoramic views along streets throughout most of the USA. Street View imagery has recently emerged in urban forestry research as a tool for quantifying greenery along streetscapes (Li et al., 2015) and locating nests of invasive pests (Rousselet et al., 2013).

Google Street View was used in a proof-of-concept study by PI Berland to inventory street trees in metropolitan Cincinnati, OH via manual interpretation of the imagery (Berland and Lange, in revision). Compared to existing field data, the "virtual surveyor" captured 93% of trees inventoried in the field. The virtual survey produced data that were 90% accurate for genus identification and 66% accurate for species identification. Diameter at breast height (DBH) was consistently underestimated in the virtual survey, but the analyst's

performance improved with experience. When plotting field DBH vs. virtual survey DBH on a graph, perfect estimation of DBH would yield a slope of 1 and R2 value of 1 for the regression line. In the virtual survey, these numbers improved from slope = 0.38 and R2 = 0.63 for the first 56 trees, and improved to slope = 0.91 and R2 = 0.90 for the final 448 trees (Berland and Lange, in revision). In future projects, training and reference materials will help improve performance at the early stages of the virtual survey. In general, this approach is simple enough to be implemented by anyone with basic skills in computing and tree identification and measurement. The virtual survey was conducted much faster than field surveys, indicating that a community could use it to quickly generate basic variables about the locations, types, and sizes of their street trees.

In a practical example of street-level image interpretation for urban forest management, Philadelphia, PA recently completed a citywide street tree inventory using manual interpretation of Cyclomedia imagery, a product similar to Google Street View (Carolan, 2016). Interns mapped 112,000 trees using a virtual survey. However, due to concerns about intern expertise identifying species and estimating DBH, only tree location and mortality status were recorded (J. Piller, pers. comm.). Our proposed study would enable cities considering virtual surveys to decide which variables to collect, and by which type of analyst, based on quantified information about analyst data quality.

Google Street View imagery can also produce street tree inventories using automated algorithms and machine learning (Wegner et al., 2016). Using this technique, species classification rates were promising (80%), but tree detection rates were only 70% (Wegner et al., 2016), considerably lower than the 93% detection rate found in our manual approach to image interpretation (Berland and Lange, in revision). Additionally, like LiDAR and hyperspectral methods, machine learning requires highly specialized computing, making it impractical for most communities. We focus on manual interpretation of Street View imagery because it is a more practical approach for communities lacking the resources to pay for more advanced techniques, and because our prior proof-of-concept study and the Philadelphia experience demonstrate the strong potential of this method for everyday urban forest management.

CITIZEN SCIENCE IN URBAN FORESTRY. We have evidence that Google Street View can be used to generate street tree data of reasonable quality, but we do not know what level of expertise is needed to produce data that are valuable for the purposes of municipal management. By including expert, intermediate, and novice participants, the proposed research will evaluate the performance of analysts with varying levels of experience inventorying urban trees. This will contribute to a broader push to characterize the benefits and challenges of involving citizen scientists in environmental research in general (Dickinson et al., 2012) and urban forestry in particular (Roman et al., in revision). Citizen science is increasingly used to simultaneously increase

public engagement in scientific inquiry, and to generate more extensive datasets than experts can generate on their own. Citizen science has a rich history in urban forestry, as cities have long enlisted volunteers to conduct street tree inventories (Bloniarz and Ryan, 1996).

One persistent concern about citizen science is the reliability of data generated by inexperienced volunteers. Co-PI Roman produced a systematic assessment of citizen science data quality for urban tree inventories in four cities (Roman et al., in revision). In that study, field data generated by citizen scientists were largely consistent with data generated by experts for variables including tree abundance (within 1%), genus identification (90% agreement), and DBH (93% of trees within 1 inch of expert values). The authors provide recommendations for training citizen scientists; for example, emphasizing a consistent definition of “street tree” could produce more consistent tree population counts, and photo examples contrasting species with similar attributes could help novice participants correctly identifying trees (Roman et al., in revision). In the proposed project, we will implement such recommendations to improve the chances of yielding high-quality data.

Where formal assessments of data quality from citizen science projects exist, they typically compare citizen data to expert data, which is assumed to be correct. This is a naïve understanding of error which assumes that expert data is flawless, when indeed, even expert-produced tree inventories have data quality issues (van Doorn, 2014). However, some citizen science and crowdsourcing projects have examined consistency among interpreters, particularly for image interpretation. For example, crowdsourcing is widely used for interpretation of land cover, and crowdsourcing in this context relies on agreement among users for data quality control (Fonte et al., 2015). Cases where several experts agree might be considered authoritative data or a “gold standard” against which volunteer data could be compared. In another example, the Galaxy Zoo project uses volunteers to classify images of galaxies by shape; when shapes are highly consistent across many volunteers, the researchers can be confident in the quality of the volunteered data and follow up to further investigate the identified galaxies (www.galaxyzoo.org). These two examples demonstrate the tremendous value of volunteers interpreting images, with the critical component of evaluating inter-observer consistency as an indication of data quality. In the proposed project, we will advance citizen science in urban forestry by evaluating the quality of data produced among analysts with different levels of expertise, quantifying the consistency of data produced within a given expertise level, and characterizing overall data quality by comparing virtual survey data to field data from the same locations.

In summary, emerging research shows that Google Street View can be used to produce data about street trees at lower cost than field surveys. It may be possible to leverage citizen scientists to conduct virtual street tree surveys using Street View, but we do not know

what level of data quality can be generated by volunteers compared to experts. The proposed project will build upon cutting edge research to characterize the feasibility of generating a quality street tree inventory with analysts ranging from novices to experts.

REFERENCES: See attached list.

Summary of project goals

The proposed project will evaluate the quality of street tree data generated virtually by manually interpreting Google Street View imagery. There are three primary goals motivating this work. First, we seek to characterize the overall performance of virtual street tree surveys by comparing imagery-derived data to field-generated reference data. We will focus on tree attributes used widely in management: the number of trees, genus and species, size class, and mortality status.

Second, we will study whether virtual surveys of street trees can be reliably conducted by citizen scientists, or if urban forestry expertise is required to generate usable data. To do this, we will determine how data quality differs according to the expertise of the analyst, and also how data quality differs among analysts in the same class of expertise.

The third goal is to help urban forest managers understand if our approach is appropriate for their communities. We will evaluate time spent on the virtual survey vs. a field survey, as well as monetary costs of both approaches. We will disseminate our findings broadly among urban forest managers, and generate resources to replicate our approach for local management uses. While we readily acknowledge that a virtual survey should not replace on-the-ground assessments by qualified professionals, our approach may be useful to urban forest managers looking to use a simple and freely available product to generate or update street tree inventories. This may be especially relevant in communities that cannot afford to conduct a field inventory.

Description of measurable outcomes expected

At present, there is only one study documenting the prospects of using Google Street View to conduct virtual surveys of street trees through manual image interpretation (Berland and Lange, in revision). That study – led by PI Berland – showed promise for generating data suitable for street tree management without physically visiting sites, but it was conducted by a single analyst with expertise in urban forestry. The proposed project will build upon this proof-of-concept study by producing the following measurable outcomes:

1. Statistical assessment of the percent agreement between the virtual survey and field data from the same place. This will include data on the following key street tree attributes: number of trees, genus and species, size class, and mortality status.
2. Quantitative analysis of agreement among analysts with varying levels of expertise (novice, intermediate, and expert) for each tree variable listed above.
3. Analysis of percent agreement among analysts with comparable expertise to determine how consistent virtual survey estimates are from one analyst to the next.
4. Evidence-based guidance for communities interested in this

approach, including a list of tree variables that can be reliably collected using virtual surveys of street trees in Google Street View, as well as evaluation of time and costs required for virtual vs. field inventories.
5. Along with these more general outcomes, we will produce field data and virtual survey data for street trees in Dolton, IL, a community interested yet financially unable to collect data that will help improve their urban forest management.

Project plan including design, hypotheses, methodology and analyses

OVERVIEW. In this study, we will generate data about street trees using virtual surveys in Google Street View, and we will compare this information to data collected in the field. We will also compare the performance of analysts with varying expertise in order to evaluate the skill level necessary to produce high-quality virtual survey data. Below we describe the study area, study design, methodology, and data analysis, and conclude by summarizing the central research questions and hypotheses.

STUDY AREA. The study will be conducted in Dolton, IL, which abuts the south side of Chicago. Dolton's population is 23,262 people, of which 25% live in poverty and over 90% are black or African American. Dolton covers an area of 4.7 square miles and contains 93 miles of local roads. Project personnel from Morton Arboretum have been working with Dolton to develop capacity for urban forest management, but the community is conspicuously lacking a street tree inventory, which renders the community ineligible for key state funding opportunities. Community leaders are interested in obtaining street tree data as a pivotal step toward improving municipal forest management.

STUDY DESIGN AND METHODOLOGY. The study will be based on an 18% random sample of Dolton's streets, or about 17 miles of street length. This is substantially higher than the 6% sample recommended for i-Tree Streets studies (i-Tree, 2012), and this sample will allow us to reliably characterize the composition of street trees in Dolton as well as the performance of virtual surveys as described below. Our previous research experiences indicate this sampling effort is appropriate for the project timeline and for generating a representative sample.

Field data will be collected along the study street segments in summer 2017 by two DePaul University students, under the guidance of co-PI Vogt. The students will receive training in field methods and species identification prior to field work. The field crew will visit each randomly selected street segment and survey all street trees present in the public right-of-way. For each tree, they will record genus, species, diameter at breast height (DBH), mortality status, and tree location by street address. We will also enumerate time spent per tree and overall field time (including transportation). Data collection will largely follow the Urban Tree Monitoring Protocol developed by the Urban Tree Growth and Longevity Working Group, an effort led in part by co-PI Roman. Because the field data will be the reference ground-truthed dataset in our analyses, the field crew will take pictures and make notes when they are uncertain of a

measurement or tree identification, so that the tree may be revisited to ensure the best field data quality possible. We expect reliable data from the field crew, because prior analysis indicates well-trained paid interns produce data that are highly consistent with expert data (88-100% consistent across several variables) (L. Roman, unpublished data). Data will be collected using the OpenTreeMap mobile application (www.opentreemap.org).

Virtual surveys will be conducted for the same street segments as the field survey. Virtual surveyors (aka analysts) will use Google Earth Pro, which is freely available. Google Earth Pro permits users to view geographic information system (GIS) files within Street View, ensuring that analysts survey the correct street segments by following a line on the computer screen. Users can also place a point on the map with a unique identifier, and those points can later be exported to GIS format to compare tree locations noted by the field crew and multiple virtual surveyors.

Virtual surveys will be conducted by three experts (PI and co-PIs), three intermediate analysts, and three novice analysts, following expertise categories from Urban Tree Monitoring Protocols mentioned above. Intermediate and novice analysts will be recruited from municipal staff and local volunteers such as Openlands TreeKeepers. To accurately characterize expertise, analysts will complete a questionnaire containing questions about relevant education, experiences in urban forestry, and self-reported confidence with tree identification and assessment. Prior to the virtual survey, analysts will receive training similar to our previous citizen science projects (3-4 hours) covering species identification and measurement techniques. We will adapt training materials (slides, field guides) already developed for the protocols used in past citizen science trainings. Species training will emphasize contrasts among species with similar leaf shape or form (e.g., maple vs. maple-like leaves of London planetree). To provide context for estimating DBH in Street View, analysts will also receive a reference guide showing Street View images of trees with the field-measured DBH listed; this substantially improved DBH estimation in our previous research (Berland and Lange, in revision).

To conduct the virtual survey, analysts will manually interpret Google Street View imagery to record the same variables collected by the field crew, including tree attributes and time spent on the survey. Because analysts cannot be expected to estimate DBH precisely using Street View imagery, DBH will be aggregated into the following size classes commonly used in urban forest management: 0-3 inches, 3-6, 6-12, 12-18, 18-24, 24-30, and >30. In addition, they will record the imagery date so we can understand whether older Street View imagery yields poorer data quality. Finally, analysts will have an opportunity to rate their confidence level on tree identification and make notes about trees, for example, when they are not sure if the tree is located in the public right-of-way.

DATA ANALYSIS. Our analysis will focus on five primary tree

variables fundamental to management activities: number of trees recorded, genus, species, DBH, and mortality status. For these tree variables, we will assess the level of agreement between the field survey and virtual surveys using both raw percentages and Cohen's kappa (following Berland and Lange, in revision; Roman et al., in revision). Cohen's kappa accounts for chance agreement between two analysts, and thus provides a more genuine portrayal of agreement than raw percentages, particularly when datasets are dominated by a small number of common items such as overrepresented species.

We will also quantify the level of agreement among users in the same expertise category, and among different expertise levels. This will provide an indication of the level of data quality that can be expected from analysts according to their expertise. Communities can use this information to decide whom to enlist as virtual surveyors, given that they may have to balance data quality needs with availability of personnel. Finally, we will compare the time and money spent completing the virtual and field surveys.

SUMMARY OF KEY RESEARCH QUESTIONS AND HYPOTHESES. This study will address the following central questions:

1. Can manual interpretation of Google Street View imagery be used to generate high-quality data about street trees? Drawing on our previous research (Berland and Lange, in revision), we hypothesize that data accuracy (i.e., agreement with field data) will be high (>85%) for the number of trees and genus identification. Accuracy will be less reliable for species identification and DBH estimation. In general, data quality will be poorer for small trees than large trees, and data quality will be higher when Street View imagery is more recent.

2. What is the level of agreement among multiple analysts conducting virtual surveys of the same trees? Similar to #1 above, we hypothesize that agreement among analysts will be high for some variables such as genus identification and mortality status, and lower for species identification, particularly for locally rare species.

3. How does data quality vary among analysts with different levels of expertise? Based on our previous research (Roman et al., in revision), we anticipate that intermediate and novice analysts will generally agree with experts on tree abundances and DBH class, but may be less adept at identifying trees to the species level, especially for less common species. Due to their more extensive training and experience, we hypothesize that experts will agree with one another more often than less experienced analysts agree with one another.

4. What time and cost savings can be expected from virtual surveys compared to field surveys? Based on our previous research (Berland and Lange, in revision), we hypothesize that virtual surveys will offer

	substantial time savings as compared to field surveys, perhaps around 50% faster, which may translate to large cost savings. REFERENCES: See attached list.
Description of plan for disseminating the results of this project	The results of this project will be disseminated in three primary ways. First, we will publish our findings in peer-reviewed journals, and the budgeted open access fees will be used to make our research freely available to practitioners and researchers. We will target scholarly journals with broad readership such as Urban Forestry & Urban Greening and Arboriculture & Urban Forestry, widely-read professional/trade publications such as Arborist News, and newsletters and blogs like the Treebune News by ACTrees. We will prioritize an article documenting the accuracy of a virtual survey of street trees compared to field data, along with analysis of agreement among virtual surveyors according to their level of expertise. Second, PI Berland will travel to a prominent urban forestry conference (International Society of Arboriculture, Partners in Community Forestry, or similar) to present the findings of this work. Sharing our results and perspectives will start a dialogue to help people decide if our techniques might be appropriate and useful in their communities. Third, we will host a workshop at Morton Arboretum that brings together urban forest professionals from greater Chicago. At this workshop, participants will get a hands-on introduction to our methodology, learn about our research outcomes, and have a chance to ask questions as they consider using Google Street View to virtually survey street trees in their communities. Any community guidance documents prepared for the workshop will be made publicly available following the workshop.
Project start date	03/01/2017
Project completion date	02/28/2019
Geographic range of project	USA & Canada

Budget

Compensation/Stipend

Proposed project budget	$11,899
Requesting from TREE Fund	$11,030
Funding from other sources	$0
Value of in-kind support from other sources	$869

Employee Benefits

Proposed project budget	$1,561
Requesting from TREE Fund	$1,257
Funding from other sources	$0

Value of in-kind support from other sources	$304

Travel (> 50 miles)

Proposed project budget	$2,500
Requesting from TREE Fund	$2,500
Funding from other sources	$0
Value of in-kind support from other sources	$0

Local Transportation (< 50 miles)

Proposed project budget	$1,251
Requesting from TREE Fund	$1,251
Funding from other sources	$0
Value of in-kind support from other sources	$0

Equipment (vehicles, growth chambers, etc.)

Proposed project budget	$0
Requesting from TREE Fund	$0
Funding from other sources	$0
Value of in-kind support from other sources	$0

Supplies (paper, ink, toner, etc.)

Proposed project budget	$887
Requesting from TREE Fund	$887
Funding from other sources	$0
Value of in-kind support from other sources	$0

Contract Labor (contractor, speaker, etc.)

Proposed project budget	$0

Requesting from TREE Fund	$0
Funding from other sources	$0
Value of in-kind support from other sources	$0

Other/Misc.

Proposed project budget	$9,782
Requesting from TREE Fund	$6,105
Funding from other sources	$0
Value of in-kind support from other sources	$3,677
Description of other/misc. expenses	Requested from TREE Fund: 1. Indirect costs at allowed rate of 10% for Ball State University and DePaul University budget items. 2. Journal article open access fees. 3. Workshop at Morton Arboretum (facility rental & refreshments for 70 attendees @ $15 each). In-kind support from other sources: 1. Unrecovered indirect costs from Ball State University and DePaul University ($3,677)

Total

Proposed project budget	27880
Requesting from TREE Fund	23030
Funding from other sources	0
Value of in-kind support from other sources	4850

Funds already received from other sources	$0
Funds pending from other sources	$0
Value of in-kind support already received from other sources	$0
Value of in-kind support pending from other sources	$4,850

How did you hear about this grant?	TREE Fund website Word of mouth

Applications will be scored on the following scale:

- Applicant is qualified (10 points)
- Applicant has experience (5 points)
- Project has potential to result in transformative research ideas or approaches (5 points)
- Project directly meets one or all TREE Fund priorities (10 points)
- Project has clearly stated need (10 points)
- Project is clearly linked to arboriculture and/or urban forestry (5 points)
- Research has practical application (10 points)
- Project design is scientifically sound, methods are clear and analysis is appropriate (15 points)
- Project is likely to result in peer reviewed publication (10 points)
- Objectives are achievable within proposed time frame (5 points)
- Objectives are achievable within proposed budget (5 points)
- Requested funds have potential to leverage future support from other funding sources (5 points)
- Requested funds are matched with at least 10% cash or in-kind (5 points)

Your application will not be available for editing after it has been submitted.
Please review your application for completion before submission.

User: justin.morgenroth@canterbury.ac.nz

Save Draft

ADMIN: Reason(s) Not Eligible

John Z. Duling Grant Application

Please note: This application may only be submitted July 1 - October 1.

If you have any questions, please email bduke@treefund.org or call 630-369-8300 x200.

Applicant

Principal Investigator

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Degrees	PhD - Forestry Science, 2011, University of Canterbury Masters of Forest Conservation, 2006, University of Toronto Bachelor of Science (Computer Science), 2002, University of Western Ontario
Relevant citations authored	A.K. Koeser, J. Roberts, J.W. Miesbauer, A. Bannwart Lopes, G.J. Kling, M. Lo, and J. Morgenroth. 2016. Testing the accuracy of imaging software for measuring tree root volumes. Urban Forestry and Urban Greening 18(1), 95 – 99. Scharenbroch, B.C., Morgenroth, J. & Maule, B. 2015. Tree Species Suitability to Bioswales and Impact on the Urban Water Budget. Journal of Environmental Quality, 45(1): 199 - 206. Morgenroth, J., Santos, B. & Cadwallader, B. 2015. Conflicts between landscape trees and lawn maintenance equipment – The first look at an urban epidemic. Urban Forestry & Urban Greening, 14(4):1054-1058. Miller, J., Morgenroth, J. & Gomez, C. 2015. 3D modelling of individual trees using a handheld camera: Accuracy of height, diameter and volume estimates. Urban Forestry & Urban Greening, 14(4), 932-940. Morgenroth, J., Visser, R., 2011. Above-Ground Growth Response of Platanus orientalis to Porous Pavements. Arboriculture and Urban Forestry 37(1), 1-5. Morgenroth, J. 2011. Root Growth Response of Platanus orientalis to Porous Pavements. Arboriculture and Urban Forestry, 37(1), 45-50. Morgenroth, J. 2008. A review of root barrier research. Arboriculture and Urban Forestry, 34, 84-88.
Has this investigator previously received funding from the TREE Fund?	Yes
If yes, was the funding for this project?	No
Previous TREE Fund awards	Image-based 3D Urban Tree Modelling. Thanks to this previous TREE Fund award, Dr. Morgenroth published two peer-reviewed scientific articles and presented at the 2014 ISA annual conference, as well as a local conference for the New Zealand Arboriculture Association. The TREE Fund was acknowledged for funding on all these occasions. Investigating Physical Soil Conditions and Tree Response to Permeable Paving. Thanks to this previous TREE Fund award, Dr. Morgenroth published 3 peer reviewed scientific articles and presented at 3 conferences (ISA 2009, 2011, and the Landscape Below Ground III) acknowledging the TREE Fund for their contribution.

Co-Principal Investigator (if applicable)

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Relevant citations authored	A.K. Koeser, J. Roberts, J.W. Miesbauer, A. Bannwart Lopes, G.J. Kling, M. Lo, and J. Morgenroth. 2016. Testing the accuracy of imaging software for measuring tree root volumes. Urban Forestry and Urban Greening 18(1), 95 – 99. A Koeser, R Hauer, K Norris, R Krouse Factors influencing long-term street tree survival in Milwaukee, WI, USA. Urban forestry & urban greening 12 (4), 562-568 JR Stewart, RD Landes, AK Koeser, AL Pettay. Net photosynthesis and growth of three novel woody species under water stress: Calycanthus occidentalis, Fraxinus anomala, and Pinckneya pubens HortScience 42 (6), 1341-1345 A Koeser, JR Stewart. Effects of transplanting on the growth and survival of nursery stock. HORTSCIENCE 43 (4), 1239-1239
Has this investigator previously received funding from the TREE Fund?	Yes

If yes, was the funding for this project?	No
Previous TREE Fund awards	Miesbauer, J. and A.K. Koeser. 2015. “Assessing Wound-induced Response Growth in Two Common Urban Tree Species”. Hyland R. Johns Grant Program. This grant has been matched $5000 by the Florida Chapter of the International Society of Arboriculture (ISA). Work is beginning this month. Koeser, A.K., R. Hauer, and R. Northrop. 2013. Urban Tree Risk Assessment – Perceptions, Reality, and Reliability. Jack Kimmel International Grant Program. This grant was matched $5000 from Florida ISA and $5500 from the Wisconsin Arborist Association and used to leverage $50,000 in internal graduate student support from the University of Florida. To date, one paper from this work is published, three are submitted, and one is in progress. The work has been presented at over a dozen conferences and workshops. Most importantly, this serves as a thesis project for a very promising arboriculture professional. Koeser, A.K. and J.R. Stewart. 2010. Consequences and impacts of wire basket retention and removal on establishment and root morphology of a shallow-rooted and a deep-rooted tree species. Tree Research and Education Endowment Fund – John Z. Duling Grant. This grant was matched $5000 from the Wisconsin Arborist Association. To date the work resulted in a publication which was featured by ISA as one of its Arboriculture & Urban Forestry CEU offerings. A second paper on the impacts of wire basket retention/removal on rooting strength is in progress. The work has been featured in multiple presentations internationally and locally.

Students/Interns (if applicable)

Student/Intern 1

Name	Andrew Benson
Department or major	Forestry Science
Status	PhD student

Student/Intern 2

Name	
Department or major	
Status	

Student/Intern 3

Name

Department or major

Status

Project

Project title	Measuring tree response to increasing root removal intensities
Research area	Root and soil management Plant health care Urban forestry
Project summary	Conflicts often exist between trees in the urban forest and an ever increasing number of buildings, footpaths, new infrastructure and underground utilities. Such conflicts frequently result in the damage or complete removal of tree roots. While avoiding root damage is the most effective strategy for preserving tree health, site constraints can put trees in close proximity with development activities. Currently, arboricultural specialists rely on industry best practice documents informed by relatively few studies when deciding if a given tree can be retained or should be removed during site development. These documents feature largely anecdotal root diameter thresholds for identifying acceptable root removal limits. These thresholds fail to account for the size of the root(s) relative to the size of the tree, and also the total number of roots to be removed. Current best management practices (BMPs) also fail to account for the cumulative effects of repeated root injury resulting from site development and eventual redevelopment or repair. Funding is requested to help further understand the implications of root removal by examining precisely how trees respond to different root removal intensities. The study proposes to monitor physiological and tree growth responses to various root removal treatments in order to provide information to assist with the proper management of urban trees. The study has been designed to answer the questions; “How do trees respond to increasing root pruning intensity?” and “what proportion of a tree’s root system can be removed without significantly affecting growth and function?”
Statement of problem	Trees are under considerable stress from repeated injury during development activities (Koeser et al. 2013). The development and re-development of sites with trees has the potential to adversely affect root systems and overall tree health. These effects can be detrimental to tree health; often leading to an overall reduction in vitality, decline and in extreme cases, mortality. Throughout much of New Zealand, an arbitrary diameter threshold of 35 mm seems to have been established through industry consensus, above which the severance of roots is usually prohibited. The British Standard BS 5837:2005 – Trees in relation to construction (BSI, 2005) and National Joint Utilities Group (NJUG) guidelines (2007) suggest that this threshold should be 25mm. Neither of these methods accounts for the age or size of the tree, nor the total

numbers of roots being removed. In the instance of a juvenile tree, a 35 mm root may very well be contributing toward a noticeable proportion of the tree's water and nutrient uptake. Conversely, a 35 mm root would unlikely be contributing towards a comparable proportion of a mature tree's uptake of the same resources, and thus its removal may be inconsequential.

In contrast, the International Society of Arboriculture Best Management Practice guide for Managing Trees During Construction (Fite and Smiley 2008) does not specify a maximum diameter threshold for root removal. Rather, its guidelines are established with respect to distance from the tree's trunk. For broad spreading trees, a tree protection zone is ideally established at the dripline. For narrow-crowned species, the tree protection zone is established based on trunk diameter. A 6:1 ratio (i.e. 6 cm/inch of buffer for each cm/inch of trunk diameter) is considered the minimum and should be applied only to young and construction-tolerant trees. A more ideal 18:1 ratio is recommended for mature and construction-intolerant trees. As with the approach adopted in NZ and the UK, the ISA BMP approach does not account for the total number of roots being removed, nor their size.

Why do we accept these approaches to adopt arbitrary root diameter thresholds or trunk diameter based root protection zones, when a far greater understanding of a tree's response to root severance is required to make critical management decisions?

British Standards Institute. (2005). BS5837:2005 Trees in relation to construction – Recommendations
Fite, K, Smiley, E.T. (2008). Best Management Practices – Managing Trees During Construction. International Society of Arboriculture, Champaign, IL. pp. 35.

Koeser A, Hauer R, Norris K, Krouse R (2013) Factors influencing long-term street tree survival in Milwaukee, WI, USA Urban Forestry & Urban Greening 12:562-568
NJUG (2007). NJUG guidelines for the planning, installation and maintenance of utility apparatus in proximity to trees NJUG Publication: Volume 4: Issue 2: 16/11/2007

Significance of your proposed project as it relates to the profession of arboriculture or urban forestry

Urban trees are potentially long-lived organisms that will likely be exposed to construction damage one or more times over the course of their lives. Unfortunately, mature trees (which provide greater environmental, economic, and social services) are generally considered less resilient to the stresses of construction. There is a need to correctly manage physical works around established trees. In these instances, arboricultural experts may be required to make 'educated guesses' about the future health of affected trees based on their understanding of how the roots of trees are managed. This can lead to cases of un-justified tree removal or ill-advised tree retention, resulting in loss of benefits or increased potential for harm, respectively.

The results of the study will assist arboricultural experts and

practitioners alike by:

1. Providing information on how trees respond to varying levels of root pruning.

2. Enabling arborists to make more defensible decisions about root pruning; particularly where planning documents, hearings or environment court decisions are involved.

3. Providing evidence which can be used in the revision and preparation of best practice documents in the years to come.

Moreover, the profession will benefit from increased international collaboration because the researchers are from three different countries (New Zealand, United States, and United Kingdom). Finally, by building research capability in a PhD student whose background is firmly in arboricultural practice, the profession will benefit by establishing a link between research and practical arboriculture.

Description of what is currently known about proposed project area

Much of the current research in relation to root removal relates to anchorage and stability and has used pull tests to determine strength loss after root removal (Hamilton, 1988; Smiley, 2008; Ghani et al. 2009; Smiley, 2014). Often the methods attempt to replicate construction activities, where trenching is used to indiscriminately sever roots at a known distance from the tree base, occasionally as a ratio of DBH (i.e. two or three times the DBH). Smiley (2008) established a relationship between trunk diameter and linear trenching and found that, in order to avoid significant changes in the force required to rotate the trunk about the root ball, trenches should be dug no closer than three times DBH to the tree trunk. Later, Smiley (2014) established a reliable correlation ($r^2 = 0.82$) between pull force and root removal using the measured cross sectional area (CSA) of roots removed, as a proportion of DBH.

Despite a focus on tree stability, there have been some studies that have measured tree growth or vitality in response to root removal. Watson (1998) examined how root removal affected tree growth and vitality, again adopting linear trenching methods to sever roots using a DBH ratio of 12:1 (i.e. trenches were made 12 cm from the tree base for each 1 cm of DBH). He exposed trees to different trenching treatments, being on one, two or three sides of the tree and found that more severe trenching resulted in greater dieback and reduced tree growth (shoot and DBH growth).

Recently, Fini et al. (2014), evaluated the long term effects of different levels of root severance on growth and physiology of two tree species. Fini recorded the same observation as Watson (1998) in relation to tree growth in response to different root removal treatments, but also examined the physiological effects of root severance. Changes in stomatal conductance were observed in root-pruned trees over the four-year period immediately following the root removal treatments, when compared to controls. As with other studies, the roots were removed indiscriminately by trenching at a

fixed distance from the tree base (i.e. not proportional to the DBH) and crucially, the extent of the root removal itself was not quantified. The study concluded that root damage indirectly induces a chronic but mild water stress to root-severed trees, even when soil water availability was not limiting.

These previous studies show that: a) DBH can be used to estimate an 'acceptable' trenching distance that limits negative impacts on stability, growth, and vitality; b) physiological measurements can be used to explain 'why' root removal negatively affects the vitality and growth of trees. But an important question remains unanswered. In all previous studies, roots were indiscriminately severed via trenching, and neither the size of severed roots, nor the proportion of total root cross sectional area affected by trenching were measured. Unfortunately, this leaves a sizeable gap in our understanding of the impacts of root removal on tree stability, growth and condition. For example, the previous research cannot be used to answer whether removing a single 35 mm diameter root from a 15 cm DBH tree will affect stability, growth, or vitality.

We propose to address this knowledge gap and to provide practical benefits to arboricultural experts and tree managers alike. The study will build on the previous research, by quantifying root removal relative to tree size and measuring responses in growth, physiology, and condition.

Fini, A. Frangi, P. Amoroso, G. Piatti, R. Robbiani, E. Sani, L. Bonanomi, L. Blotta, V and Ferrini, F. (2014). Effects of root severance by excavation on growth, physiology and stability of two urban tree species: results from a long-term experiment. International Society of Arboriculture Annual Conference, Milwaukee, WI.

Ghani, M, A. Stokes, A and Fourcaud, T. (2009) The effect of root architecture and root loss through trenching on the anchorage of tropical urban trees (Eugenia grandis Wight). Trees 23:197–209

Hamilton, W.D. (1988). Significance of root severance on performance of established trees. Journal of Arboriculture 14(12): 288-292.

Smiley, E, T. (2008) Root Pruning and Stability of Young Willow Oak. Arboriculture & Urban Forestry 34(2):123–128.

Smiley, E, T. Holmes, L, and Fraedrich, B (2014) Pruning of Buttress Roots and Stability Changes of Red Maple (Acer rubrum) Arboriculture & Urban Forestry 40(4): 230–236

Watson, G (1998) Tree growth after trenching and compensatory pruning. Journal of Arboriculture 24(1): 47-53.

Summary of project goals

1.Challenge current thinking on the management of tree root zones.

2.Describe how trees respond to increasing root pruning intensity. This will enable practitioners to determine more acceptable,

	defensible root removal thresholds designed to minimize impact on tree growth and function 3.Disseminate the research at an ISA conference and in relevant scientific and practitioner publications worldwide. We anticipate the information to be relevant to a wide audience and that the dissemination of findings will persist for some years after the study is complete. 4.Work with ISA and local chapters to incorporate the results into best practice documents in the years following the study. 5.Contribute to improving the research capability of a PhD student in arboriculture and urban forestry related studies. 6.Build bridges in international arboriculture and urban forestry research using a project team from three countries.
Description of measurable outcomes expected	We aim to produce measureable outputs that communicate the results of the research to both scientific and practitioner audiences. All written and oral outputs will identify TREE Fund as a sponsor. Our primary goal is to produce outputs that provide value to the fields of arboriculture and urban forestry with clear practical benefits. However, a secondary goal is to produce an outward facing scientific publication to highlight that cutting edge research is being conducted in our urban forests. Our measurable outputs will be: 1.A manuscript for a scientific audience (publication in one of Arboriculture & Urban Forestry or Urban Forestry & Urban Greening) 2. A technology transfer article for a practitioner audience (publication in Arborist News, City Trees, or similar industry magazine). 3.Present results at annual ISA international and local chapter conferences. 4.Manuscript for scientific audience not generally associated with arboriculture or urban forestry. This is likely to be published in a journal associated with plant physiology. 5.Developing the capabilities of a young researcher who will serve the field for decades to come.
Project plan including design, hypotheses, methodology and analyses	Research Questions: The study has been designed to use established and proven methods to answer the questions; “How do trees respond to increasing root pruning intensity?” and “what proportion of a tree’s root system can be removed without significantly affecting growth and function?” This research will be completed by a PhD student under the supervision of the co-applicants. We have worked closely with various tree suppliers, local authorities and arboricultural contractors in New Zealand and the USA to establish trial sites and secure tree stock to undertake the field work.

Study Site:
The research will be conducted at the Christchurch City Council (CCC) nursery in Christchurch, New Zealand and at the Gulf Coast Research and Education Center in Florida, USA. Having field sites in two geographically distant locations is desirable to better understand how trees respond to root severance in both a dry temperate climate (Christchurch) and a humid sub-tropical climate (Florida), and will yield a greater applicability of the results for practitioners around the world.

Trees:
We will use landscape-grade, open grown trees for our experiment. We are currently negotiating which trees at the CCC nursery we can use for the research. We will select a deciduous broadleaf species that is commonly planted in cities globally. We will include 50 trees in the Christchurch-based experiment. We have already secured 50 bald cypresses (Taxodium distichum) for the Florida-based experiment.

Experimental Design:
Trees in the experiment will either be assigned to a control group (no root severance) or a treatment group (varying intensity of root severance). Root severance will be undertaken on each of the treatment groups to encompass a wide range of root removal intensities for which the tree responses can be measured. Trenches will be excavated with an air spade on one, two, three or all four sides of each tree in the treatment groups, and roots in each trench will be severed. Importantly, the total root cross-sectional area (RCSA) for severed roots will be measured to quantify the severity and impact of trenching. This approach will achieve a range of measurable root removal intensities. The proportion of total RCSA to trunk cross-sectional area (TCSA) will be calculated and expressed as a percentage. This metric ((RCSA/TCSA) * 100) will act as a continuous variable used to explain measured changes in tree growth, condition and physiology. Specifically, the response variables that we will measure include trunk diameter at breast height and shoot extension (tree growth), crown dieback (tree condition), as well as chlorophyll fluorescence and stomatal conductance (tree physiology).

Detailed Methods:
There are four critical steps to answer the research questions. We need to 1) Undertake trenching; 2) Remove roots to establish a full range of root removal intensities; 3) Determine TCSA for all trees and RCSA for all roots; and 4) monitor tree response to root severance. These steps are expanded upon below.

1. Undertake trenching
- Use an air spade to excavate trenches on one, two, three or four sides of each tree. Trees assigned to the control group will have no trenches excavated.
2. Remove roots

- Sever all roots in each trench with a hand saw or secateurs.
- Remove severed roots from soil for measurement in next step
- Fill trenches with original soil material and lightly compact.

3. Determine TCSA and RCSA
- Measure trunk diameter (DBH) at 1.4 m above ground level.
- Estimate trunk cross sectional area (TCSA) from DBH.
- Measure the diameter of the cut end of roots removed from each trench.
- Estimate total root cross-sectional area (RCSA).
- Calculate the ratio of RCSA to TCSA as a percentage, ((RCSA/TCSA) * 100).

4. Monitor tree response to root severance
- Measure DBH monthly during the growing season
- Measure shoot extension monthly during the growing season
- DBH and shoot extension will be measured using the same methods as Watson's 1998 study to ensure our results can be compared to previous work.
- Measure crown dieback monthly during the growing season
- Measure chlorophyll fluorescence (CF) weekly during the growing season. CF is an accepted way to understand the efficiency of photosynthesis and is therefore a useful way to measure stress.
- Measure stomatal conductance (SC) weekly for all trees. SC is a measure of gas exchange and transpiration in trees, and changes in SC are a useful indicator of stress.
- Air temperature and relative humidity will be measured for all days on which CF and SC are measured as these climatic variables can significantly affect tree physiology.

Statistical analysis:
The results will be analyzed to examine the relationship between the root cross-sectional area removed and tree growth, condition, and stress responses. Statistical regression analyses will be undertaken to explain the relationship between the explanatory variable (ratio of RCSA to TCSA, expressed as a percentage) and response variables (tree growth (DBH, shoot extension), condition (crown dieback), and physiology (CF, SC)). The null hypothesis that we will test is: There is no significant effect of increasing root removal intensity on measurable growth, condition, and stress responses. Testing this hypothesis will allow us to confidently answer the stated research questions.

Smiley, E, T. Holmes, L, and Fraedrich, B (2014) Pruning of Buttress Roots and Stability Changes
of Red Maple (Acer rubrum) Arboriculture & Urban Forestry 40(4): 230–236

Watson, G (1998) Tree growth after trenching and compensatory pruning. Journal of Arboriculture 24(1): 47-53.

Description of plan for disseminating the results of this

We aim to communicate the results of the research to both scientific and practitioner audiences using various methods of dissemination.

project	All written and oral outputs will identify TREE Fund as a sponsor. Our primary goal is to produce outputs that provide value and practical benefits to the fields of arboriculture and urban forestry. The secondary goal is to produce an outward facing scientific publication to highlight that cutting edge research is being conducted in our urban forests. Our measurable outputs will be: 1.A manuscript for a scientific audience (publication in one of A&UF or UFUG) 2.A technology transfer article for a practitioner audience (publication in Arborist News, City Trees, or similar industry magazine). 3.Present results at annual ISA international and local chapter conferences. 4.Manuscript for scientific audience not generally associated with arboriculture or urban forestry. This is likely to be published in a journal associated with plant physiology. 5.Developing the capabilities of a young researcher who will serve the field for decades to come.
Project start date	10/01/2016
Project completion date	09/30/2019
Geographic range of project	USA & Canada Latin America Europe & North Eurasia Asia & Pacific Middle East Africa

Budget

Compensation/Stipend

Proposed project budget	$88,242.98
Requesting from TREE Fund	$0
Funding from other sources	$74,405.48
Value of in-kind support from other sources	$13,837.50

Employee Benefits

Proposed project budget	$0
Requesting from TREE Fund	$0
Funding from other sources	$0
Value of in-kind support from other sources	$0

Travel (> 50 miles)

Proposed project budget	$7,916.25
Requesting from TREE Fund	$7,916.25
Funding from other sources	$0
Value of in-kind support from other sources	$0

Local Transportation (< 50 miles)

Proposed project budget	$450.00
Requesting from TREE Fund	$450.00
Funding from other sources	$0
Value of in-kind support from other sources	$0

Equipment (vehicles, growth chambers, etc.)

Proposed project budget	$5,625.00
Requesting from TREE Fund	$5,625.00
Funding from other sources	$0
Value of in-kind support from other sources	$0

Supplies (paper, ink, toner, etc.)

Proposed project budget	$2,175.00
Requesting from TREE Fund	$2,175.00
Funding from other sources	$0
Value of in-kind support from other sources	$0

Contract Labor (contractor, speaker, etc.)

Proposed project budget	$5,000.00
Requesting from TREE Fund	$5,000.00
Funding from other sources	$0

Value of in-kind support from other sources	$0

Other/Misc.

Proposed project budget	$8,810.00
Requesting from TREE Fund	$3,810.00
Funding from other sources	$5,000.00
Value of in-kind support from other sources	$0
Description of other/misc. expenses	accommodation and per-diem for PhD student and technician while working at field sites away from home base. Also includes hotel accommodation costs for presenting results of this research at a future ISA conference. Also includes costs of purchasing trees for use in research.

Total

Proposed project budget	118219.23
Requesting from TREE Fund	24976.25
Funding from other sources	79405.48
Value of in-kind support from other sources	13837.5
Funds already received from other sources	79405.48
Funds pending from other sources	$15,000
Value of in-kind support already received from other sources	13837.50
Value of in-kind support pending from other sources	$0
How did you hear about this grant?	Other

Applications will be scored on the following scale:

- Applicant is qualified (10 points)
- Applicant has experience (5 points)
- Project has potential to result in transformative research ideas or approaches (5 points)
- Project directly meets one or all TREE Fund priorities (10 points)
- Project has clearly stated need (10 points)
- Project is clearly linked to arboriculture and/or urban forestry (5 points)
- Research has practical application (10 points)
- Project design is scientifically sound, methods are clear and analysis is appropriate (15 points)
- Project is likely to result in peer reviewed publication (10 points)
- Objectives are achievable within proposed time frame (5 points)
- Objectives are achievable within proposed budget (5 points)
- Requested funds have potential to leverage future support from other funding sources (5 points)
- Requested funds are matched with at least 10% cash or in-kind (5 points)

Your application will not be available for editing after it has been submitted.
Please review your application for completion before submission.

User: bkane@eco.umass.edu

Save Draft

ADMIN: Reason(s) Not Eligible

John Z. Duling Grant Application

Please note: This application may only be submitted July 1 - October 1.

If you have any questions, please email bduke@treefund.org or call 630-369-8300 x200.

Applicant

Principal Investigator

Prefix	Dr.
First name	Brian
Last name	Kane
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State/province	Massachusetts
Zip/post code	01003-9242
Country	United States
Email address	bkane@eco.umass.edu

Phone number	413.545.6637
Degrees	Ph.D.
Relevant citations authored	Kane, B. Compatibility of toothed ascenders with arborist climbing ropes. Arboriculture & Urban Forestry 37(4):180-185. Kane, B., S. Brena, and W. Autio. 2009. Forces and stresses generated during rigging operations. Arboriculture & Urban Forestry 35(2):68-74. Kane, B. 2007. Friction coefficients for arborist ropes passing through cambium saver rings. Arboriculture & Urban Forestry 33(1):31-42.
Has this investigator previously received funding from the TREE Fund?	Yes
If yes, was the funding for this project?	No
Previous TREE Fund awards	Most recent award was TREE Fund #10-HJ-01 in 2010: "Growth and Dynamic Motion of Cabled Trees with Co-dominant Trunks"

Co-Principal Investigator (if applicable)

Prefix	Mr.
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Phone number	413.545.6626
Degrees	M.S.
Relevant citations authored	
Has this investigator previously received funding from the TREE Fund?	No

If yes, was the funding for this project?	No
Previous TREE Fund awards	

Students/Interns (if applicable)

Student/Intern 1

Name	Mark E. Novotny
Department or major	not yet determined
Status	

Student/Intern 2

Name	
Department or major	
Status	

Student/Intern 3

Name	
Department or major	
Status	

Project

Project title	Measuring forces at multiple locations in rigging systems
Research area	Risk assessment and worker safety
Project summary	Arboricultural rigging carries a very high degree of risk. Climbers must estimate how much force will be generated when rigging pieces of wood, and where the cut pieces will move when being rigged. Heavy pieces of wood swinging around or shock-loading the tree have very high momentum. If they collide with the climber or the tree, severe or fatal injury, tree failure, or both can be the result. Despite the risk and the development of new gear and techniques intended to reduce the risk, very few rigorous studies have quantified the forces generated while rigging, making it impossible to know with certainty whether new gear or techniques actually reduce the risk. This proposal describes a project to measure rigging-induced loads at multiple points in a rigging system, and compare the effect of varying components of a rigging system on the loads. In particular, a variety of ropes, blocks, and rigging loads will be tested to determine their effect on loads measured at different points in the rigging

	system. These measurements will be used to determine the friction in rigging blocks and lowering devices (e.g., Port-A-Wrap, GRCS). Understanding the effect of friction has important implications for safety. Depending on the amount of friction in a rigging block, failure of the rigging rope or the anchor point (block, sling, or tree) will be more likely. Knowing how much friction a lowering device provides helps tree workers anticipate how many wraps on a lowering device are needed to carry an expected load.
Statement of problem	Rigging is inherently dangerous. Rigging branches and wood from trees can induce very large impulse loads, especially when the rigging involves shock-loading from rigged pieces that are abruptly decelerated to prevent them from damaging a target below. Rigging structurally-deficient trees exacerbates the danger because defects like decay, cracks, and weakly attached branches reduce the load-bearing capacity of the tree. Rigging-induced loads are borne by the rigging gear. At the very least, rigging gear includes a lowering rope and an anchor point. The anchor point can be on the tree from which branches and wood are being removed or it can be on a nearby tree. A very simple rigging system includes a lowering rope passed over a branch union and tied to a lower branch being removed. A ground worker holds the lowering rope (perhaps taking a wrap around the trunk of the tree to add friction which reduces the force the ground worker must apply to hold the load). Simple rigging systems have limitations. Among these are inflexibility in choosing the location of the anchor—it is mostly restricted to locations of branches, and greater rope abrasion that results from rope-on-bark friction. Friction between the rope and the bark reduces the length of lowering rope that carries the rigging-induced load. This means that fewer rope fibers must carry the load, which increases the likelihood of rope failure. To address limitations of simple rigging, arborists have adapted rigging tools from other disciplines (e.g., pulleys and blocks) and developed new tools (e.g., friction devices like the Port-a-wrap). A primary advantage of using a block with a rotating sheave is that the lower sheave friction allows more of the rope to extend under load, reducing the likelihood of rope failure. However, a more even sharing of the load between the lead and fall of the rope increases the load at the anchor point, which may increase the likelihood of its failure. New rigging blocks (X-Rigging rings, SafeBloc) have been developed to address the latter concern, but a better understanding of the friction between different types of lowering ropes and various types of blocks (those with a rotating sheave and those without) is integral to reducing risk in rigging. Similarly, knowing the amount of friction provided by a lowering device will improve tree workers' ability to safely and efficiently manage rigging loads.
Significance of your proposed project as it relates to the profession of arboriculture or	A better understanding of how rigging systems carry loads is critical to improving tree worker safety. There are many anecdotal examples of rigging system failure. Failures can be of the gear or the anchor,

urban forestry

and climber injury or fatality is almost certain. Failure of the lowering rope may be less likely to injure the climber than failure of the anchor, but damage or injury to a ground worker is still very likely if the lowering rope fails. “Climber’s Corner” features at conferences often address the risks of rigging, and new gear has been developed with the intention of reducing the risk to tree workers and property. However, without careful measurements and statistically rigorous analyses, guidelines to reduce the likelihood of failure remain, at best, educated guesses based on individual or collective experience. Cursory or sloppy measurement and analysis of rigging loads may be more problematic because it gives a false sense of confidence that a new technique or tool limits risk.

Collected empirical data can also be used to validate computer models of rigging systems. Engineering tools like finite element analysis (FEA) efficiently investigate parameters related to the likelihood of failure of an anchor or gear, but must be based on rigorous empirical data. FEA can be used to determine which input factors (e.g., rope length and elasticity, mass of the rigged piece, diameter and modulus of rupture of the branch, etc.) most affect the likelihood of failure.

Bartlett Tree Experts and N.A.T.S fully endorse this project (see attached letters).

Description of what is currently known about proposed project area

Very little empirical work has investigated loads in climbing and rigging systems, even though climber fatalities have occurred (Ball and Vosberg 2004). Blair (1989) recommended rigging larger pieces to reduce the number of cuts made with a chainsaw. He did not measure the actual cutting time, so it is unclear that this approach would reduce the likelihood of being cut. It is also unclear whether the risk is greater when cutting with a chainsaw or when the rigged piece loads the rigging system. Removing large pieces—especially when shock-loading the rigging—can induce very large loads which, in turn, induce large stresses on rigging gear (rope, block, sling, friction device) and the tree itself (Kane et al. 2009). It is possible to cause any part of the rigging system to fail (including the tree), and structurally-deficient trees, which are often rigged for removal, have a reduced load-bearing capacity.

Kane et al.’s (2009) study highlighted three important aspects of rigging loads. First, they demonstrated that mass of the piece or top was the best predictor of loads measured at the rigging block and in the fall of the rope. Mass accounted for almost 70% of the variation in rope tension and 80% of variation in force at the block for rigged pieces (i.e., branchless trunk sections). It accounted for more than 90% of the variation in rope tension and force at the block for tops. Measured loads also greatly exceeded the mass of tops and pieces when shock loading the rigging. In contrast, other factors (e.g., fall distance, angle and depth of the felling notch, and length of rope in the rigging system) accounted for less than 5% of the variation in rope tension or force at the block for pieces or tops. Secondly, they showed that theoretical predictions of rope tension assuming a falling rock climber (Pavier 1998) did not accurately predict measured

tension due to rigging loads. Third, their work revealed differences when rigging branched tops compared to pieces of the trunk, illustrating the effect of a slender stem's deflection, acting like a shock absorber, to reduce the impulse load.

The results from this project (Kane et al. 2009) provided guidelines for practitioners to rig trees safely and mostly aligned with work carried out by Detter and colleagues (Detter 2008; Detter et al. (2008). All of the studies were a useful starting point for future investigations, but each was limited. Detter et al. (2008) tested a very small sample of trees, precluding rigorous statistical analyses and hypothesis tests. Kane et al. (2009) conducted a rigorous experiment and statistical analyses, but considered only one species. To maintain experimental control, all trees were morphologically similar and all trunk pieces (except tops) were cut to the same length.

In unpublished work conducted in 2008 and 2010, Kane (In Review for publication in Urban Forestry & Urban Greening), continued collecting data to address limitations of Kane et al. (2009). The follow-up data collection tested trees of the same species and similar morphology, but pieces were cut to different lengths, accelerations near the rigging point were measured in addition to measurements of force at the block and rope tension, and some pieces were gradually lowered to the ground ("letting pieces run") rather than shock-loading the rigging system. Data collected in 2008 and 2010 (Kane, In Review) measured a threefold increase in force at the block when shock-loading compared to letting pieces run.

Although removing less massive pieces and letting pieces run clearly reduces the loads on the rigging, which, in turn, reduces the likelihood of failure of the rigging gear and the anchor (usually the tree being rigged), it is not always possible to follow these guidelines. Under severe loading conditions like shock-loading to rig large pieces of wood, it is critical to minimize the rigging-induced loads.

From a strictly mechanical perspective, two competing rigging scenarios arise to reduce loads on different parts of the rigging system. In the first scenario, friction at the anchor point is minimized to allow a greater length of lowering rope to carry the rigging load. Especially if the rope is more elastic, doing this will reduce the impulse load because the rope can stretch more to absorb the kinetic energy of the rigged piece. Minimizing friction at the anchor is usually accomplished with a conventional rigging block, although no block is completely without friction (Donzelli 1999). If a greater length of rope carries the impulse load, the rope itself is less likely to fail (Donzelli 1999). However, reducing friction in the block (or other anchor) to share the rigging load between the lead and fall of the rope, the reaction force at the anchor (whether the block, sling, or tree part to which they are attached) will increase. In the idealized case of a frictionless anchor, the anchor must carry a load that is twice what the rope itself carries (assuming that the fall and lead of

the rope remain parallel).

Instead of reducing friction in the anchor to reduce the likelihood of rope failure, increasing friction reduces the reaction force that the anchor must carry because the lead of the rope will carry more of the load than the fall. New rigging products (e.g., X-rigging rings and the SafeBloc rigging system) take this approach, but there are many variables that influence whether increasing friction truly reduces the likelihood of failure or simply shifts the analysis to another component in the rigging system. In other words, reducing the load at the anchor, while reducing the likelihood of failure of the block, sling or tree, may increase the likelihood of failure in the lead of the lowering rope. To analyze the risk in each of these scenarios, many parameters must be carefully considered: type of rope, length of lead and fall of the rope and the angle made between them at maximum load, magnitude of impulse load, load-bearing capacity of the tree itself, and perhaps others not yet known.

The two alternatives for rigging to reduce rigging-induced loads are mutually exclusive, but assume failure of different components of the rigging. Understanding better the magnitude of friction for different combinations of ropes, blocks, rope lengths in the lead and fall, and loads is critical to understanding the likelihood of failure of the rigging system. Without rigorously collected and analyzed empirical data, no assessment of the likelihood of failure will be valid.

Donzelli (1999) measured friction in three common rigging blocks, using a conventional testing method: raising and lowering known masses while measuring tension in the fall of the rope. This was a reasonable approach considering the absence of data at the time, but it does not reflect the impulse loads commonly experienced when rigging a tree (especially when shock loading). It was not possible to precisely measure the friction supplied by the block used in the follow-up study (Kane, In Review) because forces were only measured at two points (at the block and in fall of the rope) and the angle made by the lead of the rope when it was under maximum tension was not measured. With high speed videography, Detter (2008) reported that the angle between the lead and fall of the rope at maximum rope tension varied between 32 and 42 degrees from the vertical. This work was limited by a very small sample size which made it impossible to determine whether factors like stem deflection, notch depth and angle, mass and length of the piece, and varying aspects of the rigging system affected the angle. In the follow-up study (Kane, In Review), friction coefficients were calculated for an expanded range of angles presented by Detter (2008): 20 – 50 degrees.

Using the conventional testing approach (Donzelli 1999), the ratio of tension in the fall and lead of the rope that passed over a block varied with the mass being raised or lowered. The median value of all tests was 84% (Donzelli 1999), indicating that the effect of friction was not very large: equal tension in the fall and lead of the rope

occur for a (hypothetical) frictionless block. Measurements in the follow-up study (Kane, In Review) produced ratios between 51% and 58% for the range of assumed angles between the lead and fall of the rope. This suggests that under impulse loading, the frictional properties of the block are quite different than when tested conventionally. If friction is greater in conventional blocks than typically believed, tension in the lead of the rope will exceed that in the fall of the rope, reaction force at the anchor will be less, and the presumed advantages of rigging systems such as the X-Rigging rings and SafeBloc may be moot.

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Summary of project goals

The goals of this project, which is part of a larger investigation on understanding the likelihood of failure of gear and anchors when rigging and climbing, are to:
1. Provide rigorous empirical data describing the loads in various parts of climbing and rigging systems.
2. Determine the effect of relevant parameters (e.g., the type of rope and block, magnitude of the impulse load) on loads at various places in climbing and rigging systems.
3. Data from 1. and 2. will be used to calculate friction coefficients under different loading scenarios for tools used in rigging like various types of blocks (e.g., conventional, X-Rigging rings, SafeBloc) and friction devices (e.g., Port-A-Wrap, GRCS).
4. Compare data from 1. and 2. with an existing finite element model (that has been developed in collaboration with colleagues in the UMass Department of Civil & Environmental Engineering) to assess the likelihood of branch failure under loads induced by different climbing systems (moving rope system, stationary rope system) and simulated falls.
5. Disseminate results in appropriate venues (conferences, tree climbing competitions, podcasts / webinars, scholarly journals and trade magazines) to ensure that practitioners have ready access to the practical application of the findings. Bartlett Tree Experts and North American Training Solutions (N.A.T.S.) will expedite this process and have pledged support (see attached letters).

Description of measurable outcomes expected

It is expected that results from this project will be readily translated into practice, which can reduce the risk associated with climbing and rigging. Although it would be difficult to measure the change in risk, it is possible to estimate the number of tree workers and arborists who are aware of the results and how it can change their rigging practice. This should improve worker safety over time.

In addition to publishing scholarly and professional papers describing the results, and presenting results at conferences, strategic partners

on the project [(Bartlett Tree Experts and North American Training Solutions (N.A.T.S.)] can immediately incorporate results into their training programs. For Bartlett Tree Experts, this means that 800 tree workers and arborists throughout North America and in the United Kingdom will learn about the advantages and disadvantages (with respect to likelihood of system failure) of various rigging systems. In addition, last year, N.A.T.S. trained 4,850 tree workers (and had face-time with about 10,000) across North America. The outreach effort can be easily measured to gauge how many tree workers (and where they work) have better information on rigging systems. This will have an immediate, positive impact on tree worker safety.

Project plan including design, hypotheses, methodology and analyses

The null hypothesis to be tested in this project is: Independent variables (type of block, type of rope, length of rope in the lead and fall, impulse load, friction device) do not affect friction coefficients in the block through which the lowering line is run to rig a free-falling mass.

The methodology for this project will be broadly similar to conventional drop tests the work of Kane (2011), who followed the EN 12841-2006 Standard (Anonymous 2006) for testing rope grabs. In this method, a known mass free falls a specified distance (1 or 2 m) before loading a rope grab (e.g., a cam ascender) attached to a test rope. The maximum load and arrest distance are measured.

The test described in EN 12841-2006 (Anonymous 2006) will be modified to test rigging blocks and ropes. A series of Dillon EdXtreme dynamometers (11 kN capacity, accurate to 1 N, sampling at 1000 Hz) will be placed into the rigging system. One will anchor the block being tested and measure the reaction force which the block, sling, and anchor point must carry. This dynamometer will be attached to a fixed point capable of bearing substantial loads with only minimal deflection. A large, horizontal branch was used in previous tests (Kane 2011); laboratory facilities on the University of Massachusetts campus can also be used. Two additional dynamometers will measure tension in the lowering rope. For some tests, the additional dynamometers will measure tension in the fall and lead of the rope being tested. In other tests, one additional dynamometer will measure tension in the fall of the rope, and the second will measure tension in the rope after it passes through a friction device (e.g., a Port-A-Wrap or GRCS). Simultaneous measurement of loads at three locations will facilitate the calculation of friction coefficients in the block and at the friction device.

Fixed masses from 50 kg – 150 kg (greater if possible) will be attached to a separate rope that holds them in place prior to testing. A fixed free-fall distance (1 m) will be used, but the length of rope in the fall and lead of the lowering rope will be varied orthogonally (i.e., in multiples such as, 1 m, 2 m, 4 m). The total length of lowering rope will also be varied, but will be limited by the height of the anchor point. Loads will be recorded continuously and simultaneously from three dynamometers for the duration of the test (just prior to the free fall of the fixed mass until the mass stops moving once the lowering

rope stops its downward motion) by a Dillon radio controller unit. The radio controller will be connected to a laptop that records the data for each dynamometer over time. Time histories of loads at three locations in the rigging will provide better insights into whether (and how) different rigging components (types of ropes and blocks) affect not just the magnitude of the load, but also its duration. The latter is important because a force of lesser magnitude that acts for a longer duration can be comparable to a force of greater magnitude that acts for a shorter duration.

Tests will be conducted in a stratified random fashion, with randomly selected combinations of rope and block tested with each fixed mass. The effect of friction in the block will be calculated as the ratio of tensions in the fall and lead of the rope. This is not the way Donzelli (1999) calculated friction coefficients, but doing so will allow a comparison of friction on conventional blocks with friction on blocks without rotating sheaves coefficients (e.g., X-Rigging rings and SafeBloc). The same approach can be used to calculate the friction provided by a Port-A-Wrap or GRCS. For those tests, the number of wraps taken around the friction device (measured as radians of the angle of rope contact with the device) will be varied in addition to varying the type of block and rope and the fixed mass. An analysis of variance (ANOVA) will be used to compare the effects of mass, type of rope, length of rope in the fall and lead, and type of block on friction (i.e., the ratio of tensions in the lead and fall of the rope). A separate ANOVA will be used to assess the effect the same independent variables, as well as the angle of rope contact with the friction device, on friction provided by the friction device (expressed as the ratio of rope tensions in the fall of the rope and in the rope after it has passed through the friction device).

Please note that the University's audit rules do not allow me to add voluntary cost-sharing amounts to the detailed budget requested on this form. Since waived overhead cost covers the required 10% matching, that amount is all that I can indicate in the budget. However, North American Training Solutions (N.A.T.S.) has pledged support to donate gear and offer in-kind labor to conduct the experiment, which are described in detail in their letter of support, emailed to Barb Duke under separate cover. Please note, third-party contributions are shown for informational purposes only.

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Additional references listed in the literature review section

Description of plan for disseminating the results of this project

Results will be actively distributed to tree workers and arborists in the United States and globally. At least one peer-reviewed article (in a journal such as Arboriculture & Urban Forestry or Urban Forestry & Urban Greening) and one professional publication (such as Arborist News or TCI magazine) will be published from the results.

As stated above, results and their application will be disseminated

through training efforts of strategic partners [Bartlett Tree Experts and North American Training Solutions (N.A.T.S.)] at local and centralized training programs throughout North America and in the United Kingdom. This is critical because N.A.T.S. trains thousands of workers every year and Bartlett has thousands of production employees. Many of these workers do not actively read journals.

Results will also be presented at regional, national and international meetings and conferences. Brian Kane has presented over 170 seminars around the world on arboricultural biomechanics and tree worker safety, including many times at TCI Expo and the ISA Annual Conference. He has also regularly presented at regional meetings in New England (e.g., the Massachusetts Arborists Association, New England Chapter of the ISA, Massachusetts Tree Wardens and Foresters Association, and the Connecticut Tree Protective Association) and throughout the United States (since January 2016, he has presented seminars and workshops in California, Colorado, Kansas, and Washington). Development of a podcast or webinar similar to those produced by ISA's Educational Goods and Services team is also planned. Such media are easily hosted on the various UMass platforms (like Dr. Kane's webpage).

Project start date	05/01/2017
Project completion date	12/31/2019
Geographic range of project	USA & Canada

Budget

Compensation/Stipend

Proposed project budget	4171
Requesting from TREE Fund	4171
Funding from other sources	0
Value of in-kind support from other sources	0

Employee Benefits

Proposed project budget	829
Requesting from TREE Fund	829
Funding from other sources	0
Value of in-kind support from other sources	0

Travel (> 50 miles)

Proposed project budget	1200
Requesting from TREE Fund	1200
Funding from other sources	0
Value of in-kind support from other sources	0

Local Transportation (< 50 miles)

Proposed project budget	27
Requesting from TREE Fund	27
Funding from other sources	0
Value of in-kind support from other sources	0

Equipment (vehicles, growth chambers, etc.)

Proposed project budget	16500
Requesting from TREE Fund	16500
Funding from other sources	0
Value of in-kind support from other sources	$0

Supplies (paper, ink, toner, etc.)

Proposed project budget	0
Requesting from TREE Fund	0
Funding from other sources	0
Value of in-kind support from other sources	0

Contract Labor (contractor, speaker, etc.)

Proposed project budget	0
Requesting from TREE Fund	0
Funding from other sources	0
Value of in-kind support from other sources	$0

Other/Misc.

Proposed project budget	13409
Requesting from TREE Fund	2273
Funding from other sources	11136
Value of in-kind support from other sources	0
Description of other/misc. expenses	University of Massachusetts-Amherst charges 59.5% indirect costs, but the TREE Fund allows 10% (which is the requested amount listed). Matching funds are in the form of waived indirect costs (59% - 10%).

Total

Proposed project budget	36136
Requesting from TREE Fund	25000
Funding from other sources	11136
Value of in-kind support from other sources	0
Funds already received from other sources	0
Funds pending from other sources	0
Value of in-kind support already received from other sources	0
Value of in-kind support pending from other sources	0
How did you hear about this grant?	TREE Fund website

Applications will be scored on the following scale:

- Applicant is qualified (10 points)
- Applicant has experience (5 points)
- Project has potential to result in transformative research ideas or approaches (5 points)
- Project directly meets one or all TREE Fund priorities (10 points)
- Project has clearly stated need (10 points)
- Project is clearly linked to arboriculture and/or urban forestry (5 points)
- Research has practical application (10 points)
- Project design is scientifically sound, methods are clear and analysis is appropriate (15 points)
- Project is likely to result in peer reviewed publication (10 points)
- Objectives are achievable within proposed time frame (5 points)
- Objectives are achievable within proposed budget (5 points)
- Requested funds have potential to leverage future support from other funding sources (5 points)
- Requested funds are matched with at least 10% cash or in-kind (5 points)

Your application will not be available for editing after it has been submitted.
Please review your application for completion before submission.

User: francesco.ferrini@unifi.it

Save Draft

ADMIN: Reason(s) Not Eligible

Jack Kimmel International Grant Application

Please note: This application may only be submitted July 1 - October 1.

If you have any questions, please email bduke@treefund.org or call 630-369-8300 x200.

Applicant

Principal Investigator

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Relevant citations authored

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Has this investigator previously received funding from the TREE Fund?	No
If yes, was the funding for this project?	
Previous TREE Fund awards	

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Relevant citations authored	PETRALLI M., MASSETTI L., ORLANDINI S. (2011). Five years of thermal intra-urban monitoring in Florence (Italy) and application of climatological indices. Theoretical Applied Climatology, 104, 3: 349-356, DOI 10.1007/s00704-010-0349-9.

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Has this investigator previously received funding from the TREE Fund?	No
If yes, was the funding for this project?	
Previous TREE Fund awards	

Students/Interns (if applicable)

Student/Intern 1

Name

Department or major

Status

Student/Intern 2

Name

Department or major

Status

Student/Intern 3

Name

Department or major

Status

Project

Project title	Effect of topping on microclimate condition and human comfort
Research area	Plant health care Urban forestry
Project summary	Urban trees create many benefits in terms of thermal comfort and Urban Heat Island (UHI) mitigation during the summer season. These benefits are strictly linked to tree canopy, but the management of the trees in the urban environment includes pruning activities. The aim of this work is to evaluate the effects of topping on microclimate conditions in the area where tree are planted. We hypothesized that topping can affect temperature of air and soil and air relative humidity. Thus, we want to test the hypothesis that topping do not only depress tree health, but also directly reduces thermal comfort and human well being in cities. The experiment will be conducted using 96 15-year-old maple (Acer spp.) and linden (Tilia spp.) trees. Half of them will be topped in late winter, while the remaining half will be left unpruned, according to a randomized block statistical design with 4 replicates. Sensors for measuring air temperature and relative humidity during the summer season have been placed in early summer 2016 in the area of research. After topping tree growth and physiology will be checked and air and soil temperature, and air relative humidity will be continuously monitored

	for two years and the effect on human comfort will be calculated by applying biometeorological indices.
Statement of problem	Trees growing in the urban environment require periodic pruning to provide clearance and improve view (i.e. trees along roadsides), to reduce conflicts with buildings and infrastructures, to thin dense canopies and decrease wind resistance, and to improve safety by removing structural defects and by reducing canopy area exposed to wind load. Unfortunately the bad practice of topping trees is widely spread all over the world. Topping shortens the growing axis by cutting the distal portion of the branch in the internode or in between consecutive lateral branches, without preserving the leader shoot of the branch required for sound canopy growth. This affects canopy size, density and morphology, key determinants of the amount of shade casted and of water transpired. Most research on pruning of urban trees, however, focused on pruning dose and timing on tree response to wounding, on compartimentalization of wood decay fungi, on tree response in the wind, whereas to our knowledge, nobody has investigated the effects of pruning method on microclimate conditions and, as a consequence, on human thermal comfort. Previous studies discovered the role of green areas in mitigating the UHI effect in warm cities. In those studies, the air temperature across the city was reduced between 1 and 4 °C by the presence of green areas. According to the type of green area (with trees or covered only by grass), densely forested parks are generally warmer than parks without trees at night, and 1-4 °C cooler during the day. This is probably due to the canopy effect of trees that prevents radiation cooling during the night and soil heating by the solar radiation during the day. Even more dramatically, the temperature difference between shaded and non-shaded ground can be as much as 20°C (36 F), based on some studies described below. While the studies measured temperature of the ground surface, heating differences also occur at the surface of an animal's fur or a person's skin. Urban temperatures and thermal comfort affects human health and wellbeing: the perception and the sensation of thermal comfort are vital in urban form, thus further study on what settings should be provided in various types of urban from is important to sustain the urban life. Urban forests can help keep cities within a healthy temperature range, although the exact temperature reduction from urban forests is difficult to measure. The extent of the effect varies in space and in time, but management techniques, including pruning, play a key role. How do we affect urban microclimate when we improperly prune a tree? How much shading and transpirational cooling are lost along with topped branches? How long does it take to recover the pre-topping environmental benefits? Microclimatic benefits of urban trees have been widely described, but very little attention has been paid, up to date, on how they may be affected by improper management techniques, such as topping.
Significance of your proposed project as it relates to the	This project is related to urban forestry as it investigates the effect of tree topping on air temperature, relative humidity and human

profession of arboriculture or urban forestry	thermal comfort (HTC). Tree topping is unfortunately one of the techniques widely used all over the World to prune trees in urban environment. The aims of the study will be (1) to quantify the effects of topping street trees on some air parameters (mainly relative humidity and temperature) and (2) to quantify the HTC after tree topping. As such, this is a unique study that will be capable of observing not only the effect of topping on tree growth and physiology, but also the negative feedback determined on human comfort and health. To our knowledge there are no studies that have been undertaken representing neither in warm nor in temperate areas, and we are aware that many temperate cities may experience such warm summer conditions and heat events under projected climatic changes.
Description of what is currently known about proposed project area	Cities are frequently warmer than surrounding rural areas. Described as the 'urban heat island' (UHI), this phenomenon has been reported for cities worldwide. The UHI is an artefact of the complex built environment, the lack of cooling vegetation and the high density of human activities in urban areas, and is a result of differences in the energy balances of urban and rural environments. During the day, cities and the countryside receive energy from the sun and from human activities. This energy is reflected or absorbed and stored for release when the temperature of the surrounding environment drops, most notably at night-time. Differences in where the heat is stored, the amount of heat stored, the rate and extent of energy release and what happens to emitted energy combine to create the UHI. In this scenario we know that green areas have an important role in UHI mitigation: according to a variety of variables, such as the magnitude of green area, the hour of the day, the height of buildings in the surroundings, the type of green area (with trees or grass), the air temperature reduction can vary usually between 1 to 4 °C. It has been demonstrated that even a single tree or a single cluster of trees can already have positive effects on the urban thermal environment. Urban street trees can have positive effects on city air temperature and HTC although this is highly localized and variable, depending on tree cover, geometry, and prevailing meteorological conditions. The cooling benefit of street tree canopies increases as street geometry shallows and broadens and can be very different in urban plazas which are defined as open public areas that are usually near city buildings and that often have trees and bushes and places to sit, walk, and shop. Usually these areas in summertime are hit by the sun during the whole day and air and ground temperature can reach values well over the threshold of discomfort. Street trees can also help reduce high urban temperature through key vegetative processes of shading and transpiration. Shading combats the UHI in three complementary and additive ways. Firstly, by limiting solar penetration shading restricts energy storage and the heating of the local environment that subsequently occurs. Secondly, shading reduces the direct gain of energy through windows and the subsequent 'internal' greenhouse effect. Lowering air-conditioning demand leads to energy and cost savings and reduces the emission of waste heat energy. Finally, shading shelters people from direct exposure to the sun, which is important as thermal discomfort has been suggested to relate more to higher radiation exposure than

	higher air temperatures. The magnitude of cooling from a shade tree depends upon crown shape (broad being best) and density. Dense trees block more incoming solar radiation, reducing solar warming. Magnitude of cooling also depends on tree growth rate and longevity, and placement of the trees relative to the building to be shaded. It has been calculated the value of shading can be as 2.5 times greater than that of evapotranspiration cooling. However, in temperate climates the role of shading and evapotranspiration are approximately equal. Several studies suggest that an increase in vegetation can help mitigate the urban heat island (UHI), while others promote vegetation as a way of modifying urban microclimates and human thermal comfort (HTC). However urban street trees face significant challenges including development and infrastructure pressures, maintenance issues, and poor water availability at times that can compromise their ability to mitigate urban heat and improve HTC. Topping is an improper pruning technique that is, unfortunately, still widely used in cities worldwide. Despite it is long known that topping enhances decay, and it has been recently pointed out that it depresses stress tolerance, short-term economic considerations still prevail over proper tree care, and trees are then topped. In this project, we assume that topping can have negative effect also on urban microclimate and on human thermal comfort: the main benefits that urban trees produce are linked to tree canopy, that is completely removed with topping. New evidences that the negative effects of topping are not limited to the tree itself, but have consequences on human well being, may act as deterrent to topping and may assist the appraisal of topping damage to trees.
Summary of project goals	The project will provide useful information to be used to convince municipality and private owners not to top trees and how bad this practice can be for trees but also for human well-being. In particular, this project aims to: - quantify the effect of topping on air and soil temperature and air relative humidity - quantify the effects of topping on thermal comfort - measure the effects of topping on three growth and physiology - compare tree growth and physiology between topped and non topped trees - compare the effect of topping on microclimate and human thermal comfort between topped and non topped trees - determine how much time is needed to restore pre-topping conditions
Description of measurable outcomes expected	- Increase/reduction of temperature - Knowledge on tree growth and physiology after topping - Management guidelines to improve/maintain thermal comfort and human health.
Project plan including design, hypotheses, methodology and analyses	96 15-years old Norway maples (Acer platanoides), mountain maple (Acer pseudoplatanus), and linden (Tilia spp.) have been selected in an experimental plot near Milan (North of Italy). 10-12 cm (4-5 in.) circumference. Trees were planted in 2005, in mixed stands, spaced 6 m in-row and 3.5 m between the rows. Plants have been grown for

	several years in the field, are uniform in size, and reached full canopy closure in 2013. The experimental field was divided into 300 m2 plots, each planted with 12 mixed maple and linden trees, according to a randomized block design with 4 blocks. Plots will be either topped or left unpruned. In topped plots, all plants will be topped by chainsaw cutting of primary branches. Branches will be pruned close to the crotch as unfortunately is often done by municipalities and private owners. The remaining half trees will be left unpruned as a control. Sensors to measure air temperature and relative humidity have been placed around the trees in late spring 2016 to monitor the microclimate around the trees during the summer season before topping. These sensors were all located at the same distance from tree trunks and at 1,5 m height, in order to collect air temperature and relative humidity at pedestrian level. Growth in topped and unpruned trees will be determined through measurement of shoot growth, stem diameter growth, and canopy size. To estimate transpirational cooling, leaf gas exchange will be measured, with a particular reference to daily trends of transpiration per unit leaf area. This value, integrated over the whole leaf area (calculated from crown projection measurements and leaf area index), allows the calculation of water transpired by trees over the day and, by consequence, of the consequent cooling benefit. Leaf gas exchange will be measured monthly during the growing season using an infra-red gas analyzer. We showed in a previous experiment that leaf characteristics and leaf temperature are affected by topping. Because these traits are correlated to the emission of Volatile Organic Compounds (VOCs), which important pollutants in cities, VOC emission will be determined in topped and unpruned plants. This will allow to evaluate a side effect that topping may have on human health
Description of plan for disseminating the results of this project	The results of this project will be disseminated through presentations at professional meetings that include both academic and industry scientists and publications in peer-reviewed and industry publications, this will include reports and other documents. We plan to organize meetings with stakeholders to present the results of this study. The dissemination will be also done through workshops, national and international conferences and through the most important social networks (online discussion lists, tweets, Facebook posts, photos, etc.).
Project start date	03/01/2017
Project completion date	02/28/2019
Geographic range of project	USA & Canada Latin America Europe & North Eurasia Asia & Pacific Middle East Africa

Budget

Compensation/Stipend

Proposed project budget	10000
Requesting from TREE Fund	5000
Funding from other sources	5000
Value of in-kind support from other sources	0

Employee Benefits

Proposed project budget	0
Requesting from TREE Fund	0
Funding from other sources	0
Value of in-kind support from other sources	0

Travel (> 50 miles)

Proposed project budget	6000
Requesting from TREE Fund	2000
Funding from other sources	4000
Value of in-kind support from other sources	0

Local Transportation (< 50 miles)

Proposed project budget	0
Requesting from TREE Fund	0
Funding from other sources	0
Value of in-kind support from other sources	0

Equipment (vehicles, growth chambers, etc.)

Proposed project budget	7000
Requesting from TREE Fund	2000
Funding from other sources	5000
Value of in-kind support from other sources	0

Supplies (paper, ink, toner, etc.)

Proposed project budget	0
Requesting from TREE Fund	0
Funding from other sources	0
Value of in-kind support from other sources	0

Contract Labor (contractor, speaker, etc.)

Proposed project budget	0
Requesting from TREE Fund	0
Funding from other sources	0
Value of in-kind support from other sources	0

Other/Misc.

Proposed project budget	2000
Requesting from TREE Fund	1000
Funding from other sources	1000
Value of in-kind support from other sources	0
Description of other/misc. expenses	Cost of publication Production of informative leaflets

Total

Proposed project budget	25000
Requesting from TREE Fund	10000
Funding from other sources	15000
Value of in-kind support from other sources	0
Funds already received from other sources	0
Funds pending from other sources	15000

Value of in-kind support already received from other sources	0
Value of in-kind support pending from other sources	0

How did you hear about this grant?	TREE Fund website TREE Fund newsletter TREE Fund conference booth Social media (Facebook, LinkedIn)

Applications will be scored on the following scale:

- Applicant is qualified (10 points)
- Applicant has experience (10 points)
- Project directly meets one or all TREE Fund priorities (10 points)
- Project has clearly stated need (10 points)
- Project is clearly linked to arboriculture and/or urban forestry (10 points)
- Research has practical application (10 points)
- Methods are clear (10 points)
- Objectives are achievable within proposed time frame (10 points)
- Objectives are achievable within proposed budget (10 points)
- Requested funds are matched with at least 10% cash or in-kind (10 points)

Your application will not be available for editing after it has been submitted.
Please review your application for completion before submission.

TREE FUND
Cultivating Innovation

User: ordonez.camilo@gmail.com

Save Draft

ADMIN: Reason(s) Not Eligible

Jack Kimmel International Grant Application

Please note: This application may only be submitted July 1 - October 1.

If you have any questions, please email bduke@treefund.org or call 630-369-8300 x200.

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Relevant citations authored	Ordóñez, C., Duinker, P., Sinclair, J., Beckley, T., Diduck, J. (2016) Determining public values of urban forests using a sidewalk interception survey in Fredericton, Halifax, and Winnipeg, Canada. Arboriculture & Urban Forestry 42 (1), 46-57. Ordóñez, C. (2015). Adopting public values and climate change adaptation strategies in urban forest management: a review and analysis of the relevant literature. Journal of Environmental Management 164, 215–221, http://dx.doi.org/10.1016/j.jenvman.2015.09.004. Ordóñez, C., Duinker, P. (2015). Climate change vulnerability assessment of the urban forest in three Canadian cities. Climatic Change 131 (4), 531-543, http://dx.doi.org/10.1007/s10584-015-1394-2. Duinker, P.; Ordóñez, C.; Steenberg, J.; Miller, K.; Sydney, T.; Nitoslawksi, S. (2015) Trees in Canadian cities: indispensable life form for urban sustainability. Sustainability 7 (6), 7379-7396, http://dx.doi.org/10.3390/su7067379. Ordóñez, C., Duinker, P. (2014) Urban forest values of the citizenry in three Colombian cities. Society & Natural Resources 27 (8), 834-849, http://dx.doi.org/10.1080/08941920.2014.90589 Ordóñez, C., Duinker, P. (2014) Assessing the vulnerability of urban forests to climate change. Environmental Reviews 22 (3), 311-321. http://dx.doi.org/10.1139/er-2013-0078. Duinker, P.N.; Steenberg, J.; Ordóñez, C.; Cushing, S.; Perfitt, K.R. (2014) Governance and urban forests in Canada: roles of non-government organisations. Proceedings of Trees, People, and the Built Environment II Conference, Birmingham, UK, 2-3 April 2014, 151-159. (Online: www.charteredforesters.org/resources/download-library/doc_download /320-tpbeii-conference-proceedings/) Ordóñez, C.; Duinker, P.N. (2014). Urban Forest Vulnerability to Climate Change: Research Synthesis Report for three Canadian cities (Halifax, London, and Saskatoon). School for Resource and Environmental Studies, Dalhousie University: Halifax, NS, Canada, 50 pp. Ordóñez, C., Duinker, P. (2013). An analysis of urban forest management plans in Canada: implications for urban forest management. Landscape and Urban Planning 116, 36–47, http://dx.doi.org/10.1016/j.landurbplan.2013.04.007. Peckham, S.C.; Duinker, P.; Ordóñez, C. (2013) Urban forest values in Canada: Views of citizens in Calgary and Halifax. Urban Forestry & Urban Greening 12 (2), 154–162, http://dx.doi.org/10.1016/j.ufug.2013.01.001. Duinker, P.; Ordóñez, C.; Steenberg, J.; Diduck, J.; Cushing, S.;

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Has this investigator previously received funding from the TREE Fund?	No
If yes, was the funding for this project?	
Previous TREE Fund awards	

Co-Principal Investigator (if applicable)

Prefix	Dr.
First name	Andrew
Last name	Millward
Status	Professor
Title	Dr.
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Degrees	Ph.D. (Geography), Department of Geography University of Waterloo, Waterloo, ON, Canada, 1998-2004 Masters of Science (Geography), Department of Geography University of Guelph, Guelph, ON, Canada, 1996-1998

	Bachelor of Science (Environmental), Faculty of Environmental Science,University of Guelph, Guelph, ON, Canada, 1991-1996
Relevant citations authored	Kershaw, S.E., Millward, A.A. (In Press) A spatio-temporal index for heat vulnerability assessment. Environmental Monitoring and Assessment. DOI: 10.1007/s10661-011-2502-z Millward, A.A., Paudel K., Briggs S.E. (2011) Naturalization as a strategy for improving soil physical characteristics in a forested urban park. Urban Ecosystems 14:261-278. Millward, A.A., Sabir, S. (2011) Benefits of a forested urban park: what is the value of Allan Gardens to the city of Toronto, Canada? Landscape and Urban Planning 100:177-188. Greene, C.S., Millward, A.A., Ceh, B. (2011) Who is likely to plant a tree? The use of public socio-demographic data to characterize client participants in a private urban forestation program. Urban Forestry & Urban Greening 10:29-38. Millward, A.A. (2011) Urbanisation viewed through a geostatistical lens applied to remote-sensing data. Area 43:53-66. Millward, A.A., Sabir, S. (2010) Structure of a forested urban park: implications for strategic management. Journal of Environmental Management 91:2215-2224. Millward, A.A., Kraft, C.E., Warren, D.R. (2010) Ice storm disturbance greater along terrestrial-aquatic interface in forested landscapes. Ecosystems 13:249–260. Millward, A.A., Piwowar, J.M., Howarth, P.J. (2006) Time-series analysis of medium-resolution, multisensory data for identifying landscape change. Photogrammetric Engineering and Remote Sensing 72:653-663. Millward, A.A., Kraft, C.E. (2004) Physical influences of landscape on a large-extent ecological disturbance: the northeastern North American ice storm of 1998. Landscape Ecology 19:99-111. Mersey, J.E., Millward, A.A., Martinez-R, L.M. (2002) Realizing the potential of GIS in community-based management of protected areas. International Journal of Sustainable Development and World Ecology 9:208-222. Millward, A.A., Mersey, J.E. (2001) A.A. Conservation strategies for effective land management of protected areas using an erosion prediction information system (EPIS). Journal of Environmental Management 61:329-343. Dr. Andrew Millward (2012) | Associate Professor of Geography | Principal Investigator, Urban Forest Research & Ecological Disturbance (UFRED) Group Millward, A.A. Mersey, J.E. (1999) Adapting the RUSLE to model soil erosion potential in a mountainous tropical watershed. Catena 38:109-129.
Has this investigator previously received funding from the TREE Fund?	No
If yes, was the funding for this project?	
Previous TREE Fund awards	

Students/Interns (if applicable)

Student/Intern 1

Name	Vadim Sabetski
Department or major	Geography
Status	Intern

Student/Intern 2

Name	Mihai Grosu
Department or major	Geography
Status	Intern

Student/Intern 3

Name	
Department or major	
Status	

Project

Project title	Investigating Street Tree Decline and Mortality in Commercial Urban Spaces Revitalized with Structural Soil Cell Technology to Improve Planting and Maintenance Practices
Research area	Root and soil management Propagation, planting and establishment Plant health care Urban forestry
Project summary	The challenge of growing trees in commercial and highly-urbanized areas in cities will affect the success of the urban forest enhancement agenda, which is the focus of urban forest management across North America. Structural soil cell technology can improve habitat quality for trees in these spaces and was used most recently to plant trees as part of Toronto's Bloor Street revitalization. These trees faced subsequent decline and high mortality. There is a lack of research on these landscapes and this technology, so it is unclear why these trees failed. Assessing the factors that contributed to their decline and mortality is necessary to guide future decisions about the use of this technology. This will ensure the success of the urban-forest enhancement agenda, reduce costs of tree planting and maintenance, and help companies and cities develop sound guidelines for street plantings in commercial

and highly-urbanized areas in cities. This research project will analyse already-existing soil and biophysical data from the Bloor Street trees and use multi-variate regression and contingency analysis techniques to elucidate the factors that have contributed the most to tree decline and mortality in Bloor Street. The information emanating form this project will be made accessible to urban forest managers and other stakeholders through research reports, academic publications, workshops, conference presentations, and webinars, and train one Canadian student in contemporary urban forest issues.

Statement of problem

North America is paying more attention to its urban forests. Municipalities are releasing first-ever management plans where they are committing to double or triple their tree planting goals (1). Enhancing the urban forest helps maximize quality of life since trees provide important ecosystem services, including regulation of urban heat and air quality (2). Economically, street trees attract shoppers to commercial areas by improving the aesthetic appeal of streets (3).

However, growing trees in the harsh environment of commercial, highly-urbanized city streets is difficult. A wide array of stressors can cause tree decline and premature mortality in these spaces (4). Urban streetscapes are commonly characterized by small, stressed, and short-lived trees (5). One technique that can improve growing conditions for street trees are underground structural soil cells, such as Silva Cells®. This technology was used in the Bloor Street Revitalization project, located in one of Toronto's main shopping districts. Despite significant forethought for street tree health, and substantial investment in underground infrastructure, many of the trees have not thrived or have died, requiring frequent re-plantings at increasing costs. There is not enough research on this technology today to provide a clear answer as to what happened. Therefore, it is essential that we understand the factors that contributed to the failure of the Bloor Street trees. This event may instigate municipal agencies, businesses, and other clients, to express reservation to proceed with future projects of a similar scope and scale. This will be an unfortunate outcome from a commercial standpoint, since companies leading the implementation of this technology may encounter resistance for their products. This is also unfortunate for the City's ambitious goals to increase urban-tree canopy (1).

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T.B.; Schipperijn, J.S. (ed.) Urban forest & trees. Berlin: Springer, 281-323.
5. Roman, L. A.; Scatena, F. N. (2011). Street tree survival rates: Meta-analysis of previous studies and application to a field survey in Philadelphia, PA, USA. Urban Forestry & Urban Greening, 10, 269-274.

Significance of your proposed project as it relates to the profession of arboriculture or urban forestry	This project will contribute to the Tree Fund's research priorities in propagation, planting, and establishment; risk assessment; and urban forestry management. I will develop an understanding on the abiotic factors influencing street tree decline and mortality in commercial urban spaces revitalized with structural soil cell technology. This will help me identify the most effective planting techniques that ensure the survival and vigorous growth of trees in commercial and highly-urbanized street settings. This understanding will be used to develop better planting and maintenance guidelines for new tree plantings in these spaces to ensure the success of the urban enhancement agenda in North America. Given my experience in urban forest management research in Canada, I have the connections needed to disseminate the results of my research to landscape architecture companies, urban forest managers, city planners, and practitioners, such as arborists and tree planting contractors. Finally, I want to expand my Canadian-based research into the US, and Tree Fund support is vital to give my research notoriety there.
Description of what is currently known about proposed project area	Research on urban forests has clearly established that urban trees help maximize quality of life through the provision of important ecosystem services, including regulation of urban heat (1), air quality (2), stormwater runoff (3), among many others. Besides providing important environmental services, urban trees contribute to the economic activity of urban areas. Street trees attract shoppers to commercial areas by improving the aesthetic appeal of streets (4,5). Given the ambitious urban-forest enhancement agendas of many North-American municipalities that are committing to double or triple their tree planting goals (6), the incorporation of trees into commercially-relevant urban landscapes is of growing importance. However, determining the most effective standards and practices for including trees in urban streetscapes is a difficult and multi-faceted technical challenge. Causes of the decline and mortality of street trees are numerous in heavily built-up areas, and trees are large, complex organisms that may exhibit multiple responses when stressed. Among the most important factors abiotic factors we find soils and water availability, damage, and light availability (7,8). Soil quantity and quality are important factors in urban tree decline. City streets, and their below-ground infrastructure, are highly engineered environments that are characterized by compacted, contaminated soils, with insufficient nutrient content, volume, and too dry or too saturated conditions (8,9). De-icing salts, in particular, contribute to the decline in newly planted city trees growing in northern climates (10). Although some information is known about damage to buds and roots system by sodium chloride (10,11), not a lot is known about magnesium- or calcium-based salts, although

they are increasingly being used as alternatives in urban landscapes (12). Healthy soils are essential to the lifecycle of trees, as they provide the rooting medium and essential nutrients for above-ground growth (13).

Damage and limited light availability may also contribute to tree decline and mortality. Trees are not immune to anthropogenic damage, which may include vandalism, mechanical damage, and improper handling and maintenance at the time of planting or pruning, all of which disproportionally affect street trees because of their exposed, high-traffic setting (9). Moreover, the geometry and density of buildings and other urban structures affects irradiation (i.e., sunlight available for photosynthesis and plant growth). Although this has been suggested as a factor in urban tree growth and mortality in general terms (14), the specifics of its effects in commercial and highly-urbanized areas is still unclear.

Beyond these physical stressors, other social factors, such as decision-making processes during design projects, including nursery stock selection, the timing of tree planting, among others, can also be major contributors to the decline and mortality of urban trees (9). However, investigations into the abiotic factors contributing to street tree decline are usually undertaken at a big spatial scale (14), making it difficult to know which factors contribute more to tree decline and mortality in specific tree-planting projects.

The factors above contribute to urban tree decline, resulting in the small, stressed, and short-lived trees that commonly characterize urban streetscapes (15). Street trees in commercial areas are the most vulnerable and suffer disproportionate rates of mortality among the young and newly-planted (14,15,16). In North America, such, trees in urban landscapes can last from 5 to 20 years (15,16), a considerable shortcoming given that trees can live to 75years or more. Short-lived trees not only provide less services and benefits (15), but ultimately cost more to maintain and replace. Urban-tree planting guidelines (17) are usually not specific enough to guide the planting of trees in these highly-engineered environments.

To maximize the benefits of city trees, the incorporation of greening objectives in the early stages of architectural design are required to grow large, healthy trees that provide maximal benefits. One increasingly used technique to improve growing conditions for street trees are the installation of underground structural soil cells, which can significantly improve growing conditions (18). This was the intent behind the installation of Silva Cell® structural soil cells in the Bloor Street Revitalization project, located in one of Toronto's main shopping districts. Despite significant forethought and planning for street tree health in this project, and substantial investment in underground infrastructure, many of the trees have not thrived or died, and have required frequent re-plantings at increasing costs. The Bloor Street corridor in Toronto is typical of streets in dense urban cores where tree establishment and growth is routinely difficult.

Silva Cells® are a relatively new technology and there is little academic research on best practices for their use in commercial streetscapes. There is also insufficient, site-focused research on potential causes of tree decline and mortality in commercial streetscapes. Research on these topics can enhance and refine innovative techniques and best management practices for designing, planting, and maintaining street trees and the physical environment necessary for their establishment and growth, specially in high-cost and high-profile design projects. This will help us avoid loss of resources on tree mortality and replacement, and ensure the long-term success and public approval of design projects. The scientific and technical advancements resulting from this project will contribute to the landscape architecture, arboriculture, and urban forestry industries that are growing in number and influence across North America.

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2. Nowak, D.J.; Hirabayashi, S.; Bodine, A.; Greenfield, E.J. (2014). Tree and forest effects on air quality and human health in the United States. Environmental Pollution 193, 119-129.
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9. Lu, J. W., Svendsen, S. E., Campbell, L. K., Greenfeld, J., Braden, J., King, K., & Falxa-Raymond, N. (2010). Biological, social, and urban design factors affecting young street tree mortality in New York City. Cities and the Environment 3, 1-15.
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11. Zimmerman, E.M.; Jull, L.G. (2006). Sodium chloride injury on buds of acer platanoides, tilia cordata, and viburnum lantana. Arboriculture & Urban Forestry 32 (2), 45-53.
12. Cunningham, M.A.; Snyder, E.; Yonkin, D.; Ross, M.; Elsen, T.

(2008). Accumulation of deicing salts in soils in an urban environment. Urban Ecosystems 11 17-31.
13. Craul, P. J. (1999). Urban soils: Applications and practices. New York, NY: Wiley.
14. Jutras, P., Prasher, S. O., & Mehuys, G. R. (2010). Appraisal of key biotic parameters affecting street tree growth. Arboriculture& Urban Forestry 36 (1), 1-10.
15. Nowak, D.J.; Kuroda, M.; Crane, D.E. (2004). Tree mortality rates and tree population projections in Baltimore, Maryland, USA. Urban for Urban Green 2 (3), 139-147.
16. Roman, L. A., & Scatena, F. N. (2011). Street tree survival rates: Meta-analysis of previous studies and application to a field survey in Philadelphia, PA, USA. Urban for Urban Green, 10, 269-274.
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18. Urban, J. (2008). Up by roots: Healthy soils and trees in the built environment. Champaign, IL: International Society of Arboriculture.

Summary of project goals

My research project will answer the following questions: 1) what are the factors influencing the decline and mortality of newly planted urban trees in Bloor Street, Toronto?; 2) what guidelines can be developed to reduce tree decline and mortality in commercial and highly-urbanized spaces revitalized with structural soil cells? My objectives are to: 1) analyse already-existing biophysical data from Bloor Street trees; 2) examine these analytical results to produce information on factors affecting tree decline and mortality in commercial and highly-urbanized spaces revitalized with structural soil cells; and 3) develop guidelines for the enhancement and refinement of tree planting in commercial and highly-urbanized spaces revitalized with structural soil cells.

Description of measurable outcomes expected

This research project will last for 8 months, although Tree Fund support is only requested for 3 months. The results of the project will be communicated to stakeholders of the Bloor Street revitalization project and the broader urban forestry industry through several deliverables, including a spatially-referenced database of biophysical information of Bloor Street trees, a final and detailed project report, two manuscripts for consideration in peer-reviewed academic journals (Arboriculture & Urban Forestry, Urban Forestry & Urban Greening), articles in industry and trade magazine publications, a conference presentation (International Society of Arboriculture), a workshop for researchers and practitioners, and a webinar (Urban Natural Resources Institute). A refined and improved best practices manual for tree planting in designed streets, with special attention to the use of structural soil cells in northern climates, will be a final and critical deliverable. Lastly, I will train one masters-level Canadian student in contemporary urban forest management issues, such as analysis of street tree data and tree-planting specifications, which can bring cutting-edge knowledge to their professional practice. The proposed study will lay a foundation for prospective future research in the next five years concerning ongoing tree-planting projects in Canadian cities. For instance, we expect to develop a second phase of investigation for the Queens Quay Revitalization project in Toronto. This project is similar to Bloor Street in species selection,

soil volumes, and urban characteristics, and would offer a unique opportunity to apply the results of the proposed research study.

Project plan including design, hypotheses, methodology and analyses

My approach to the questions pertaining street tree decline and mortality in commercial urban spaces revitalized with structural soil cell technology is innovative, as I don't want to address decline and mortality at the city-wide scale, but focus on a representative, high-profile case study.

The purpose of the proposed project is to investigate and isolate the causes of decline and mortality of these street trees in the Bloor Street shopping district that were planted or replanted in between 2011 and 2015. The Bloor Street Revitalization project experienced high rates of tree mortality and decline, which were planted with Silva Cell® technology. Such a circumstance presents an opportune learning experience concerning approaches to maximizing street tree health and resilience, while, at the same time, is an opportunity to refine urban street tree planting methods that will result in new practices and associated productivity for the broader landscape architecture industry in Canada. Understanding exactly what went wrong in a scenario where such high levels of consideration and investment in street tree survival were present in the initial design process is critical.

Several hypotheses have been put forward as potential causes of decline and mortality among the Bloor Street trees. However, rarely does one stress agent kill a tree; rather, tree failure and death is usually the cumulative effect of several stressors over a period of time (1). Besides collecting soil and wood samples, reconstruction of possible causes of tree mortality along Bloor Street will necessitate forensically piecing together different physical and biological elements of site design, accounting for the influence of surrounding infrastructure and the built environment, the history of the planted stock, and project decision-making.

During the spring and summer of 2015, Ryerson University's Urban Forest Research and Ecological Disturbance (UFRED) Group collected soil and vegetation samples from the 133 London planetrees (Platanus x acerifolia) removed as part of the on-going streetscape revitalization. UFRED has also collected samples from the new trees (American elm, Ulmus Americana; Kentucky Cofee tree, Gymnocladus dioicus), to add to the available data. Soil texture analysis and the measurement of soluble salt concentrations (e.g. electrical conductivity or batch analysis), pH, and organic matter will be investigated as potential soil-related causes of decline and mortality. Trunk cross-sections from all removed trees will also be analyzed to measure tree age and tree response to growing conditions. Emergence of tree roots into the soil within the structural cells will be interpreted and analyzed using high-resolution imagery taken during the tree extraction process. Other information is being collected from archival records held by the City of Toronto and private contractors involved in the initial revitalization project, and through the Google Street View tool. These data include tree condition, location, distance to curb, nursery stock information, re-

planting information, and weather information (e.g. maximum and minimum temperatures and precipitation during 2011-2015). A shadow model is being built to extract light-availability data for each street tree in the heavily built-up environment of Bloor street. Multivariate regression analysis and contingency analysis (2) will be used to analyse the data and explore factors of influence that are statistically relevant.

Tree Fund support is requested for contracting labour from a commercial lab to process the soil samples for salts, nutrient content, and organic matter content, at an estimated cost of $39CAD/sample for a total of 130 soil samples. I will hire a student research assistant from Ryerson University's Urban Forest Research and Ecological Disturbance (UFRED) Group for the period Mar-May 2017 at a rate of $1,666/month, inclusive of benefits. The research assistant will assist me with: 1) data inputting and database management; 2) drafting of the texts to be included in future reports and publications; and 3) assistance in organizing workshops and webinars with practitioners and stakeholders. Other expenses of the project, such as attendance to conferences, workshop costs, transport, equipment, supplies, and software packages are included in the budget but will eventually be sourced from a research grant already in place at Ryerson University and from Ryerson's financial support mechanisms, which includes personal budget for conference travel, software packages, minor research expenses, and in-kind through Ryerson's on-site facilities.

Contact with stakeholders of the project, including the City of Toronto, the landscape architecture firm DTAH, the Bloor Improvement association, and James Urban – a respected expert in urban arboriculture and soils and senior advisor for the Bloor Revitalization project – has already been established.

This project is being co-led with Dr. Andrew Millward, Professor at Ryerson University, whose work has consistently upheld the goal of protecting and enhancing the urban forest through innovation, collaboration and excellence in engaging stakeholders on all levels. He is the recipient of the 2015 Ryerson University research award for Social Innovation and Action, which celebrates his accomplishments at the cutting edge of environmental public engagement with the goal of bolstering citizen interest in and protection of city trees. Dr. Millward is lead investigator for Ryerson University's Urban Forest Research and Ecological Disturbance (UFRED) Group.

As the principal investigator, I have the interdisciplinary background and research experience to complete this project. I co-launched an urban forest management research agenda at Dalhousie University and published eleven peer-reviewed journal articles. In my PhD dissertation I initiated research to develop an understanding of how urban forests are vulnerable to climate change (3,4). My research helped broaden the palette of ecological and social priorities for urban forest management (5,6,7) and helped understand it holistically (8). I will execute this project according to the highest standards

based on my research qualifications. For instance, I have been dealing with urban forest issues for six years, and have a thoroughly grounded knowledge of the literature and the people behind it. I bring supervision skills to involve research assistants and students in my research. As the only PhD student in two research projects, I coordinated the activities of the research group and co-supervised five master theses and one bachelor thesis.

Finally, as a permanent resident in the process of becoming a Canadian citizen, I am committed to help Canada build a strong urban forest scholarship. Tree Fund funding will allow me to seed my research program, take my research to a broader audience, train Canadian students in urban forest management issues, and help me launch a successful research career that will have a significant impact in North America by influencing the community of practice. I look forward to becoming a research fellow and contributing to Tree Fund's research priorities.

1. Roman, L. A., & Scatena, F. N. (2011). Street tree survival rates: Meta-analysis of previous studies and application to a field survey in Philadelphia, PA, USA. Urban for Urban Green, 10, 269-274.
2. Jutras, P., Prasher, S. O., & Mehuys, G. R. (2010). Appraisal of key biotic parameters affecting street tree growth. Arboriculture& Urban Forestry 36 (1), 1-10.
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4. Ordóñez, C.; Duinker, P.N. (2015). Climate change vulnerability assessment of the urban forest in three Canadian cities. Clim.Change 131 (4), 531-543.
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Description of plan for disseminating the results of this project

Besides the reports to the Tree Fund, the results of the project will be communicated to stakeholders of the Bloor Street revitalization project and the broader urban forestry industry through several deliverables, including a spatially-referenced database of biophysical information of Bloor Street trees, a final and detailed project report, two manuscripts for consideration in peer-reviewed academic journals (Arboriculture & Urban Forestry, Urban Forestry & Urban Greening), articles in industry and trade magazine publications, a conference presentation (International Society of Arboriculture), a workshop for researchers and practitioners, and a webinar (Urban Natural Resources Institute). A refined and improved best practices manual for tree planting in designed streets, with special attention to

	the use of structural soil cells in northern climates, will be a final and critical deliverable.
Project start date	03/01/2017
Project completion date	04/30/2017
Geographic range of project	USA & Canada

Budget

Compensation/Stipend

Proposed project budget	11910
Requesting from TREE Fund	0
Funding from other sources	11910
Value of in-kind support from other sources	0

Employee Benefits

Proposed project budget	4998.9
Requesting from TREE Fund	4998.9
Funding from other sources	0
Value of in-kind support from other sources	0

Travel (> 50 miles)

Proposed project budget	2500
Requesting from TREE Fund	0
Funding from other sources	2500
Value of in-kind support from other sources	0

Local Transportation (< 50 miles)

Proposed project budget	100
Requesting from TREE Fund	0
Funding from other sources	50
Value of in-kind support from other sources	50

Equipment (vehicles, growth chambers, etc.)

Proposed project budget	1000
Requesting from TREE Fund	0
Funding from other sources	500
Value of in-kind support from other sources	500

Supplies (paper, ink, toner, etc.)

Proposed project budget	1200
Requesting from TREE Fund	0
Funding from other sources	0
Value of in-kind support from other sources	1200

Contract Labor (contractor, speaker, etc.)

Proposed project budget	5070
Requesting from TREE Fund	5070
Funding from other sources	0
Value of in-kind support from other sources	0

Other/Misc.

Proposed project budget	1000
Requesting from TREE Fund	0
Funding from other sources	0
Value of in-kind support from other sources	1000
Description of other/misc. expenses	Software packages & licenses

Total

Proposed project budget	27778.9
Requesting from TREE Fund	10068.9

Funding from other sources	14960
Value of in-kind support from other sources	2750
Funds already received from other sources	0
Funds pending from other sources	14960
Value of in-kind support already received from other sources	0
Value of in-kind support pending from other sources	2750
How did you hear about this grant?	TREE Fund website

Applications will be scored on the following scale:

- Applicant is qualified (10 points)
- Applicant has experience (10 points)
- Project directly meets one or all TREE Fund priorities (10 points)
- Project has clearly stated need (10 points)
- Project is clearly linked to arboriculture and/or urban forestry (10 points)
- Research has practical application (10 points)
- Methods are clear (10 points)
- Objectives are achievable within proposed time frame (10 points)
- Objectives are achievable within proposed budget (10 points)
- Requested funds are matched with at least 10% cash or in-kind (10 points)

Your application will not be available for editing after it has been submitted.
Please review your application for completion before submission.

Sonoma State University
Center for Environmental Inquiry

Research Proposal

Integrated Vegetation Management on Powerline Rights-of-Ways:

Effects of Vegetation Treatment on Plant Communities and Wildlife Diversity

Submitted to the TREE Fund

November 20, 2016

Contact: Dr. Christopher M. Halle
halle@sonoma.edu

A. Executive Summary

Vegetation management needed to maintain safety in powerline ROWs has significant effects on local ecosystems. A series of studies on the east coast has identified many of these impacts, but translating these results to ecosystems on the West Coast is problematic. Even identical management techniques may have dramatically different effects in different ecosystems.

We propose to establish and begin research on a long-term monitoring network on west coast powerline Rights of Ways (ROWs). Initially, the network will consist of the three study sites in central California: SSU's Fairfield Osborn Preserve, Pepperwood Preserve, and the El Dorado National Forest (Figure 1). These sites are envisioned as collaborative sites where studies by other researchers are actively encouraged.

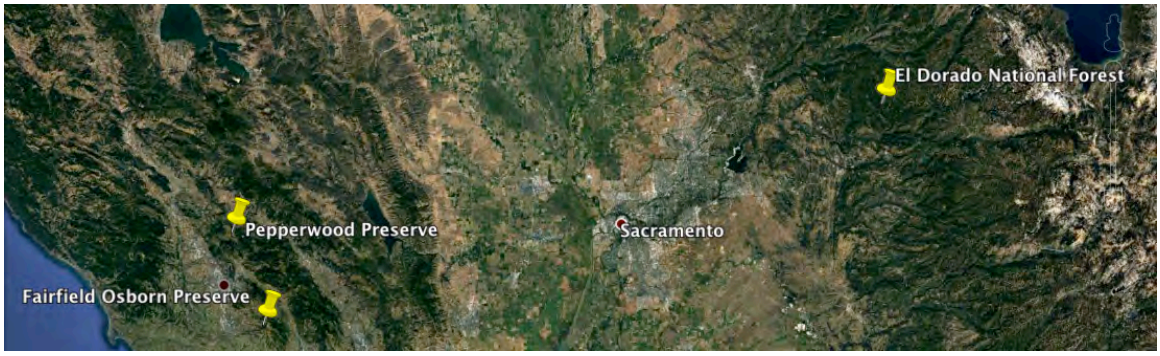

Figure 1. Locations of the Three Proposed Study Sites. Habitat at Fairfield Osborn Preserve consists mainly of oaks, bay laurel, and grasslands. Pepperwood Preserve includes a mixture of oaks, grasslands, and conifers. The habitat at El Dorado is a mixed conifer forest, located at the edge of the 2014 King Fire.

The primary purpose of the initial research at the three sites is to compare: (1) the relative costs and ability of two integrated vegetation management (IVM) treatments ("mechanical only" and "mechanical-plus-herbicide") to establish low-growing, stable, non-invasive plant communities, and (2) document the effects of these treatments on plants and pollinator behavior.

In this initial 2-year study, we will:

1. Establish 3 long-term monitoring sites on powerline ROWs in California.
2. Initiate a study on the effects of integrated vegetation management techniques on plant and animal communities.
3. Recruit additional research and provide student and public education on ROW management.

Partnerships: We will partner with utility companies, universities, and non-profits throughout the proposed work. Powerline utility company partners, Pacific Gas and Electric Company and Sacramento Municipal Utility District, will be undertaking IVM treatments in all ROWs. Site partners hosting the long-term monitoring sites are Sonoma State University, Pepperwood Preserve Foundation and the US Forest Service. Partners undertaking the work outlines in this proposal include Pollinator Partnership, Shelly Benson, and Pepperwood Preserve. In addition, throughout the proposed effort, we will be working to recruit additional research and industry partners.

Budget: The work will be undertaken over a 2-year period with a cost of $89.1K the first year, and $85.9K the second year (for a total of $175K).

B. Introduction

The longest continuous study of the effects of right-of-way (ROW) vegetation management on local ecosystems began on Pennsylvania State Game Lands in 1953 [e.g., Aurora Consulting, 2013; Bramble and Byrnes, 1983; Holt and Orr]. Although the initial proposal was to study the efficacy of herbicides in vegetation management, the study has grown over the years to include effects on wildlife, pollinator utilization, and other variables. The ROW habitat created through large tracts of forest appears to support increased abundance of small mammals, birds, and pollinators [e.g., Bramble, et. al., 1992; Bramble, et. al., 1997; Bramble, et. al., 1999; Forrester, et. al., 2005; Yahner, et. al., 2002; Yahner, et. al., 2003; Yahner, 2004].

Utility companies across the country have used these results to develop best practices, provide information on impacts, permitting, etc. However, many professionals have questioned whether the results are applicable to other areas of the United States. Especially questionable is the application of results to California ecosystems, with its much drier and more variable Mediterranean climate, more diverse habitats, and high diversity of species. California is recognized globally as a biodiversity hotspot, one of 34 sites on earth that contain 60% of the plant and animal species.

In 2015, Sonoma State and PG&E began exploring the idea of establishing long-term research on the effects of ROW vegetation management in California. Initial studies were undertaken as part of the Nature!Tech Collaborative, which explores how LiDAR and other technologies can be used to enhance academic research into vegetation management practices. Studies included LiDAR-based biomass estimates, microclimate sensor development, wildlife movement, and pollinator use of the ROW at Sonoma State's Fairfield Osborn Preserve [Clark, 2016; Diaz and Halle, 2015; McGuire, 2016a, 2016b; McGuire and Farahmand, 2016; Romero and Clark, 2016; Wininger, 2016; Wininger and Rank, 2015; Zhong and Halle, 2015].

How the Proposed Project Addresses Research Objectives

The primary goal of this proposal is to extend the research from studying the effects of ROWs on ecosystems to include studying the establishment of stable ROW sites on the U.S. West Coast. The proposed three sites are anticipated to provide an initial backbone, with the goal of developing a ROW monitoring network. Similar to the east coast monitoring studies, the purpose of this research is to provide information to utility companies that can inform best management practices for integrated vegetation management (IVM) activities. Working with utility companies, agencies, non-profits, and academic partners, we propose to address the following research objectives:

1. Create a network of long-term monitoring sites on powerline ROWs in California. We will start this process by:

    a. Establishing three long-term ROW monitoring sites in a diversity of California habitats that provide protected areas for research and educational opportunities.
    b. Working with utility companies and researchers to develop common protocols to characterize each site.
    c. Establishing baseline conditions by reconstructing site histories (e.g., fire, grazing, vegetation removal, herbicide applications), and gathering available data from existing research near each site (e.g., LiDAR studies, wildlife camera studies, soil characterization, fire reconstruction)

    Anticipated Products:

    - Maps with location of ROW monitoring sites
    - Site descriptions, including site histories and available data
    - Industry articles

2. Initiate a study on the effects of integrated vegetation management techniques on plant and animal communities. Specifically, we will investigate (1) the relative cost and ability of two types of IVM treatments (mechanical only vs selected herbicide/mechanical) to create low-growing stable non-invasive plant communities and (2) the effects of the two treatments on plants and pollinators. We will kickoff this long-term study at the 3 sites by:

    a. Working with utility companies and researchers to integrate timelines for treatment and surveys, and develop a process for tracking treatment costs (including internal utility company costs).
    b. Establishing research plots at the three ROW monitoring sites
    c. Surveying vegetation and pollinators

d. To the extent possible, compiling and sharing resulting data in professional publications and conferences (see Methods for timing considerations)

Anticipated Products:

- Written descriptions of survey protocols that can be used to conduct identical surveys at additional sites should the network be extended
- Utility cost estimate protocol describing how level of effort and cost for each treatment is tracked
- Map of the locations of research plots at each site
- Summary of changes in vegetation, pollinator abundance, and treatment costs

3. Share information on the project. A long-term objective of the ROW monitoring network is to share research results, encourage studies by other researchers, and create educational opportunities for students and the general public. We will make headway towards these objectives by:

    a. Creating a web portal for researcher, student and public engagement
    b. Inviting researchers, especially those with research interests near the ROW study sites, to planning meetings
    c. Seeding additional research with a small research incentive fund
    d. Hiring university students for field support activities and possible public outreach
    e. Integrating project information and results into existing public tours

    Anticipated Products:

    - List of resulting conference presentations and submissions to professional or scientific publications.
    - Website detailing the location of the network, treatments, and availability for research and education
    - List of incentive grants awarded to researchers, other researchers engaged, students benefitting, and public tours

C. Methods

Establish ROW Monitoring Network

We propose to establish 3 sites as an initial ROW monitoring network that supports long-term studies of ROW processes (Figure 1). Prior to this proposal, we visited all three sites with PG&E, SMUD, or TREE fund representatives to ensure that these sites meet the needs for long-term monitoring. The three sites are:

- SSU's Fairfield Osborn Preserve – A 450-acre site with ROW dominated by oaks, bay laurels, and grasslands.
- Pepperwood Preserves – A 3200-acre site that includes a mixture of oaks, grasslands, and conifers.
- El Dorado National Forest – The site chosen is in mixed coniferous forest, located at the edge of the 2014 King Fire. To combat the sire, one section of the ROW was bladed to bare earth and seeded with a USFS approved seed blend. Another section of the ROW burned during the fire. The vegetation in the two sections has responded very differently, and provides an opportunity for documenting differing responses to previous disturbances.

The 3 sites have extensive ROWs, host diverse vegetation types, are adjacent to plant communities with different or no management, and are reasonably protected from intruders. All sites include relatively flat areas making them amenable to effective treatment applications.

In addition, to meeting the above criteria, both Osborn and Pepperwood are protected sites that promote research and education. Because they are on protected lands, these sites provide a somewhat unique opportunity to obtain some background history and document "initial environmental conditions" prior to the initiation of treatment protocols in this proposal [Mahan, pers. comm., 2016]. The sites provide opportunities for using existing data to reconstruct site history, collaborating with researchers on site, and incorporating information about the ROW monitoring network into existing public tours and education programs. A variety of research data are also available at each site, including wildlife camera trapping observations, climate measurements, bird surveys, vegetation surveys, and archeological histories. The datasets that already exist can help document issues of importance to ROW establishment and management [see https://www.sonoma.edu/cei/osborn/ and http://www.pepperwoodpreserve.org for more complete lists of datasets at each preserve].

All 3 sites also have the potential to attract additional partners to undertake other research projects on the ROW monitoring network. The Osborn Preserve and Pepperwood Preserve regularly work with over 60 community partners, participate in regional planning efforts, and support on-going studies from other researchers (e.g., invasive species, fire and fuel loading, plant diseases, and wildlife movements.) At the El

Dorado National Forest Site site, there is potential to develop partnerships with the US Forest Service and Sierra Pacific Industries. Many of the management issues faced by the Forest Service are suitable for being addressed by utility industry IVM practices [e.g., Johnstone, 2008].

Study Design Approach

A priority of this study is that results be publishable in both peer-reviewed journals and technical industry publications. The most important way to ensure publishable results is by creating a sampling design that will allow for rigorous statistical analyses. However, the level of effort is necessarily constrained by budget and trade-offs between level-of-effort and exact questions to be addressed. One of the toughest tradeoffs in the proposal is balancing the need for detailed vegetation mapping with the requirement to include pollinator studies at the sites. In our proposed study design, we took the following considerations into account:

1. Number of Sites: Current priority identified in the TREE Fund RFP is to study ROW processes over a broad geographic range and diversity of habitats. We have chosen sites ranging from near the coast to the Sierra foothills.

2. Number of Treatment Areas (Sections) at Each Site: If we were investigating the IVM response at each of the 3 sites separately and in detail, we would want to increase the number of treatment areas. Each of the 3 sites may contain many different plant community types, and each community type would require at least 6 or more pairs of treatments for statistically rigorous investigation of each site and plant community. This extended approach is outside the scope of this budget, and we propose a sampling design instead that allows comparison of responses to the two IVM treatments across all plant communities and sites.

3. Size of Treatment Areas (Sections): A large number of small IVM treatment areas would be beneficial for statistical rigor, but would be complicated for utility contractors to implement, and increase the likelihood of incorrectly applied treatments. Many large numbers of small sections would also make interpreting pollinator surveys tricky at best. For this study, we have identified 100-m long treatment areas that can be clearly marked with treatment signs for utility contractors.

In summary, the proposed sampling design establishes a network with a broad geographic distribution that focuses on measurement of IVM responses at each treatment area. The design allows for comparison of responses across all sites. If desired, the number of sites and treatment areas can be increased in the future to better understand community-specific responses at each of the specific sites.

Treatment Areas

Two treatments will be applied at each of the three ROW monitoring sites. At each site, we will identify two sections of ROW ~ 200 meters long x 10 meters wide. The initial design calls for each of these sections to be subdivided into 2 treatment areas (Figure 2) and treated either mechanically or with a combination of mechanical means and herbicides. Treatment areas will be clearly marked and include treatment signs for utility partners who will be doing the treatments. An annual site visit prior to each treatment will ensure that signs remain in place.

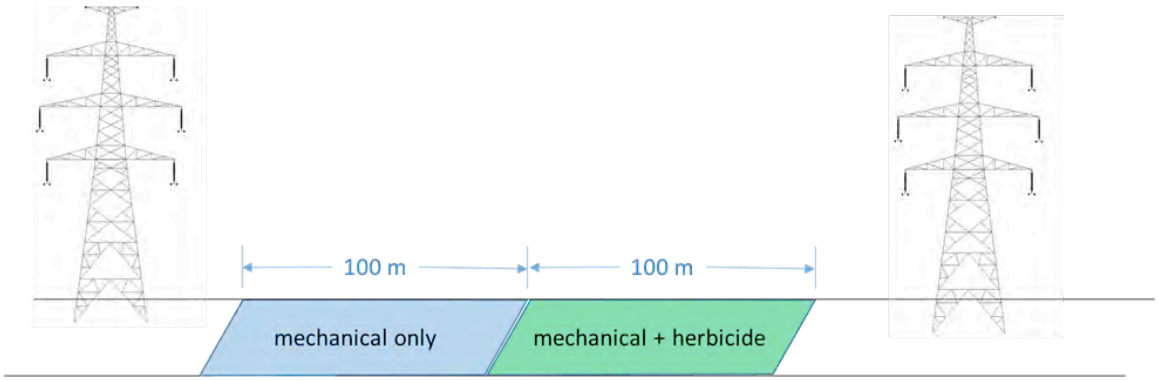

Figure 2. Schematic detailing two treatment plots in a section of ROW. The exact size of each treatment area may vary slightly depending on field conditions.

The two treatments to be investigated are based on standard practices used by utility companies to remove and prevent regrowth of undesirable plants into powerline safety exclusion zones. While the specific approaches to be used will depend on the plant community to be treated, the approaches generally are:

- removal of plant biomass within the fire safety zone of the powerlines. A variety of standard utility company techniques will be used.
- biomass removal followed by selective spot spraying of topical herbicides known to be effective on the particular species being targeted.

Utility company vegetation management personnel will be responsible for deciding on and applying the appropriate treatments. A critical component of this study is to fully document how the treatment is applied on each plot (i.e., how much biomass was removed, which species, etc.) and the cost and level of effort required. We will work with utility company personnel to develop and maintain a process to track cost and level of effort (i.e., internal expenses) needed to apply and document the treatments.

Due to budget restrictions, we propose to limit initial studies to vegetation monitoring and pollinator response. Measuring wildlife and pollinator habitat quality beyond standard vegetation descriptions are not included in the proposal, although future funding could provide an opportunity to determine whether vegetation data collected could be used to quantify habitat quality. We also do not propose to investigate wildlife movements as part of this proposal. However, for both projects, we will explore opportunities for recruiting research partners interested in other ROW processes (such as larger animal movement) using the Researcher Challenge Grants provided for in the budget.

A primary driver of vegetation response is rainfall. Rainfall can determine not only plant growth rates, but also which species germinate and determine the long-term composition of vegetation communities. To place study results in context of changing environmental conditions, we will collect weather data from each of the 3 ROW monitoring sites. Of the 3 sites, only the El Dorado site does not have a nearby weather station. We will install a station there to document rainfall as well as other environmental conditions (temperature, relative humidity, wind speed and direction, and soil moisture).

Planning and Logistics Kick-Off Meeting

We will host a kick-off meeting among utility company (SMUD, PG&E) vegetation management teams and researchers to:

- Discuss sampling design - The meeting will focus on tradeoffs between budget, level of effort, number of plots, plot size, and treatment logistics. While we don't anticipate major revisions to the proposed design, the team may decide to decrease the size of the plots and increase the number of plots per section.
- Identify detailed treatments. We anticipate that the utilities will be providing the expertise needed to characterize specific treatments – both mechanical and herbicide.
- Identify specific schedule for treatments and surveys. A high degree of coordination and partnership is required between utility company (PG&E and SMUD) personnel who will be undertaking the treatments and researchers who will be measuring responses.
- Encourage participation by additional researchers

Establish Site Histories

We will compile histories and available historical observations that can be used to place treatment results in perspective and recruit additional research. The catalogue will include existing data available (e.g., weather data, remote sensing, etc.) either as raw data or published research.

Vegetation Response to Treatments (Lead: Ms. Shelly Benson):

Documenting changes in vegetation caused by ROW management practices is critical for understanding IVM treatment effects. A goal of utility companies is to establish low-growing native communities within the ROW. Long-term changes can include, among others, invasion by non-native species, transformation of habitat types (e.g., forest to shrubland), and structural changes in plant growth.

Although general relevee surveys (mapping percent cover of species) are adequate for documenting IVM response, transect surveys are generally employed by many vegetation researchers who track vegetation changes through time. In order to make the ROW research more broadly applicable, we have decided to use transect surveys for vegetation monitoring. Transects are more labor intensive, but have the additional advantage of quantifying variability within a given plot, and may be more suitable than relevee surveys for detecting subtle changes. We are planning on 10 transects per plot, but this number can be modified if needed during the kick-off meeting.

Each plot will be sampled once per year. Surveys will be conducted in the spring, the best time of year for surveying the dominant flowering species at each location. Survey times will differ at each site, and will be dependent on timing the surveys to capture the dominant flowering species. An annual survey is the minimum needed to document the establishment of low-growing non-invasive species, but is not adequate to capture the annual cycle of all possible flowering species.

Two experienced botanists will perform the fieldwork, assisted by student interns from Sonoma State. Interns will also assist with data entry and analysis.

Pollinator Response to IVM Treatments (Lead: Dr. Victoria Wojcik)

Pollinators are considered a key indicator of general ecosystem health. In 2015, the Pollinator Partnership established monitoring sites at the Osborn Preserve to determine the effects of the ROW on pollinator abundance. Initial results indicate that native bees are more abundant in the ROW than in nearby open habitats.

Many questions remain, however. Previous research has indicated that pollinators may selectively travel along ROW pathways, increasing the distance that they are able to effectively forage. This increases the potential to facilitate connectivity between landscapes that require pollinator and potential refugia. Still, the information that exists regarding the function of ROWs as pollinator habitat is limited. In addition, it is also possible that pollinators and other insects may serve as vectors for diseased such as sudden oak death.

We will expand the pollinator program by adding monitoring sites at the El Dorado National Forest and Pepperwood Preserves. Sites will be located with the IVM plots. The establishment of sites on three preserves will allow pollinators to be studied in a range of climates, habitats, and vegetation treatment types. Future publications could also examine changes of pollinator availability and relationship to regrowth, pollinator use of various ROW habitat resources,, and the influence of vegetation management strategies on pollinator abundance. At a minimum, this effort monitors pollinators in various landscapes over time, adding key information to our understanding of pollinators in natural and managed landscapes.

The first year (2017) will include a final (third) study year at the Fairfield Osborn Preserve, completing a standard sampling protocol of three years at the site. Preliminary surveys of the remaining sites will begin in 2017. Observations will begin in earnest at El Dorado and Pepperwood in 2018. Pollinator sampling may continue at Fairfield Osborn as well in 2018, based on available funding or interest from outside researchers and students.

Pollinator data will be collected every two weeks from the beginning of native plant bloom (approximately April). Data collected will catalogue native bees, butterflies, moths, and flies that are visiting flowering plants (both native and non-native) in each management treatment and sites representative of unmanaged land. Collectively, the observations will allow us to understand patterns in pollinator support for a wide range of species. Observations will be collected by interns working closely with Pollinator Partnership project manager and research director, Dr. Victoria Wojcik.

Partnerships and Outreach (Leads: Dr. Chris Halle and Dr. Claudia Luke)

A long-term objective of the ROW monitoring network is to share research results, encourage studies by other researchers, and create educational opportunities for students and the general public. We will stimulate these activities by:

- Sharing information about the ROW monitoring network – We will create a web portal for researcher, student and public engagement. Website development is an effective tool for communicating with the general public, other utilities, and outside researchers. We will launch a simple web-based platform that can be expanded in the future.
- Recruiting additional research – We will recruit other researchers to engage in research at the ROW monitoring sites by (1) inviting additional researchers, especially those with research interests near the ROW study sites, to planning meetings, (2) distributing information about the study via conversations and the website, and (3) seeding additional research with a small research incentive fund. Grants of $500 - $1K can attract researchers such as graduate students to the ROW monitoring network sites. Examples of ancillary studies that could be leveraged in this manner include work with LiDAR, soil characterization, fire history, large animal movement, and the effects of ROWs on the spread of sudden oak death.
- Sharing research results – In the second year (2018), we will reimburse travel costs for researchers presenting findings at professional conferences.
- Creating training opportunities – Two to four student interns will support field work and data entry, and will additionally serve as public ambassadors for the project.
- Educating the public – We will integrate project information and results into existing regular public tours programs at Osborn and Pepperwood Preserves.

Contingencies

If the primary objectives of the proposal (vegetation and pollinator responses) require more funding than anticipated (e.g., due to unanticipated field conditions, etc.), we will reduce funding allocated for research incentive grants and travel costs and apply savings to field work.

D. Timetable

Here we provide an initial estimate of the timetable and schedule for the 2-year project. The schedule may be revised as required by utility vegetation treatment efforts.

	2017				2018			
	Jan-Mar	Apr-Jun	Jul-Aug	Sep-Dec	Jan-Mar	Apr-Jun	Jul-Aug	Sep-Dec
Planning and Information Gathering								
Kickoff Meeting								
Site History Descriptions								
Treatment and Cost Tracking Protocols								
Field Treatments and Research								
IVM Treatment (by Utility Companies)								
Vegetation and Pollinator Surveys								
Data Analysis								
Research Incentive Awards								
Reporting and Communication								
Annual Report and Presentation				#1				#2
Conferences and Potential Publications								
Web Portal								
Public Tours								

#1 Annual Report Deliverables

- Site History Descriptions, including maps, site histories and available data
- Link to Web Portal
- IVM Treatment and Cost Tracking Protocols
- Summary of Vegetation and Pollinator Results
- List of Research Incentive Awards and Public Tours

#2 Annual Report Deliverables

- Web Portal Updates
- Summary of Vegetation and Pollinator Results
- List of Research Incentive Awards, Conference Presentations, Publications, and Public Tours

Annual summary reports will be provided electronically to the TREE Fund and utility partners at the end of each calendar year. Earlier write-ups are possible if required, but would be more descriptive of program setup with less emphasis on knowledge gained. An annual end-of-year presentations to PG&E and SMUD senior management will be scheduled jointly. (No budget has been allocated for presentations to the TREE fund on the east coast).

It is anticipated that at least a few years of study will be required prior to making definitive statements regarding the efficacy of the two IVM treatments on vegetation and pollinators. The earliest we anticipate publication would be 2019. However, because pollinator research began two years ago at the Osborn Preserve, it is possible that FOP pollinator observations may be able to be published after the 2017 field campaign.

We propose support within the budget to present at conferences about the project approach and preliminary results. If requested, we could alternatively use these funds to present at industry meetings.

E. Principal Investigator Qualifications Statement

We provide qualifications statements for the lead project managers and researchers engaged in this project.

Project Director: Claudia Luke, Director SSU Center for Environmental Inquiry

Dr. Luke earned her Ph.D. in Zoology from UC Berkeley. She has 20 years of experience directing field stations for the University of California and California State University systems. She served as Principal Investigator for the Coastal Prairie Enhancement Feasibility Study, which investigated various vegetation management techniques and mapped resulting habitats. At Sonoma State University, she serves as Director for three SSU Preserves (Fairfield Osborn Preserve, Galbreath Wildlands Preserve, and Los Guillicos Preserve) which support career development opportunities and innovative research on environmental topics. She has worked extensively with partners and collaborators to build regional research and management collaborations in the areas of watershed management, habitat connectivity, habitat restoration, and environmental education.

Project Manager: Chris Halle, Nature!Tech Lead, SSU Center for Environmental Inquiry

Dr. Halle has extensive experience managing and leading cross-disciplinary research teams to address complex large-scale projects for industry. His areas of expertise include environmental observation and sampling, data quality control, algorithm development, and data synthesis and presentation. As Nature!Tech Lead, he creates industry-academic research collaborations on environmental and technology projects. He assists faculty in scoping and developing projects suitable for classroom instruction, and supervises students undertaking long-term monitoring projects on preserve lands. He led establishment of the camera trapping and microclimate systems on the PG&E Right-of-Way at SSU's Fairfield Osborn Preserve.

Lead Researcher Vegetation Surveys: Shelly Benson, Biological Consultant

Ms. Benson has a Master of Science degree in Natural Resources and Environmental Studies from the University of Northern British Columbia, Canada, 2001. She has worked as a botanist in the San Francisco Bay Area for fifteen years—the past six years as an independent biological consultant. Her expertise is in mapping and classifying vegetation communities, conducting botanical assessments for special status plant species, and designing and implementing vegetation monitoring programs. She is also a lichenologist and works on several projects that use lichens as biological indicators of air quality and climate.

Lead Researcher Pollinator Surveys: Vicki Wojcik, Research Director, Pollinator Partnership

Dr. Wojcik has been working to protect and promote pollinators with Pollinator Partnership since 2011. As Research Director she oversees P2's research program, keeping on top of new and emerging pollinator issues and managing a program set that includes pollinator habitat conservation and landscape management assessments, understanding and enhancing agroecosystems, landuse and pesticide policy review, support for threatened and critical species, and ecosystem service assessments. Her contributions to pollinator research and conservation include numerous peer reviewed papers, book chapters, policy pieces, planting guides, and technical manuals. She is currently leading the pollinator research effort on the ROW at the Fairfield Osborn Preserve.

F. CV of Principal Investigator or Project Manager

See separately attached 2-page resumes of the Project Director Claudia Luke and Project Manager Christopher Halle

G. Potential Partners List

We provide here a list of all project partners, including names, titles, affiliations and roles on the research team.

Name	Title	Affiliation	Role
Chris Halle, PhD	Nature!Tech Lead	SSU Center for Environmental Inquiry	Project management, site history development, treatment and cost tracking protocols, website development, kickoff meeting, researcher and student recruitment and coordination, climate summaries.
Claudia Luke, PhD	Director	Center for Environmental Inquiry	Project oversight, partner engagement, researcher and student recruitment
Peter Beasley	Vegetation Program Manager Expert	Pacific Gas & Electric Company	IVM Treatments at Osborn, Pepperwood, and El Dorado ROW
Eric Brown	Electric Transmission & Distribution Program Manager	Sacramento Municipal Utility District	IVM Treatments at El Dorado ROW
Shelly Benson, M.A.	Field Botanist	Plant Ecologist	Lead researcher for vegetation surveys
Vicki Wojcik, PhD	Research Director	Pollinator Partnership	Lead researcher for pollinator Surveys
Michelle Halbur, M.A.	Preserve Ecologist	Pepperwood Preserve	Long-term ROW monitoring site host and vegetation survey support
Suzanne DeCoursey, M.A.	Nature!Ed Lead	SSU Fairfield Osborn Preserve	Long-term ROW monitoring site host

We would like to acknowledge the assistance of Professor David Ackerly (UC Berkeley) who provided helpful discussions on the scope of the project and also expressed interest in participating in the project kick-off meeting. Professor Ackerly is performing similar monitoring at Pepperwood Preserves, and is interested researching the role of fire in the Sierras.

We also thank Professor Carolyn Mahan (Pennsylvania State University) for helpful discussions regarding ROW history and research possibilities, as well as kindly sharing the outline of her latest research proposal.

In addition to those identified in the table, we will be working to recruit research and industry partners to collaborate on-going research. Possible partners include Dr. Michelle Goman (soil characterization and fire history reconstruction), Dr. Matthew Clark (LiDAR and Remote Sensing), Dr. Nathan Rank (Sudden Oak Death), Dr. Gurman Gill (Automated Image Processing), Sonoma County Water Agency, Sierra Pacific Industries, and the United States Forest Service.

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I. Budget

Please see attached budget.

The TreeFund requires a 10% match for grant applications (17.5 K in this case). We meet the matching fund requirement through unrecovered institutional overhead costs (65K).

J. Partner Documentation

Attached separately to this proposal are letters of support from partners undertaking field surveys as part of the proposed research: Dr. Vicki Wojcik (Pollinator Partnership) and Ms. Shelly Benson (Plant Ecologist).