PROPOSAL TEMPLATE

Forest Service use only.

Control Number: _____

COVER SHEET

2015 U.S. Forest Service

National Urban and Community Forestry Challenge Cost-Share Grant Program

Proposals are due by May 15, 2014, 11:59 PM Eastern

INNOVATION GRANT CATEGORY:

(An estimated total amount of $900,000, may be available, approximately $300,000 per category)

Check one category per application. More than one application may be submitted by an organization.

- ☐ Category 1: Incorporating Urban Forests as Green Infrastructure into Urban Planning Practices that will result in improvements for ecologically underserved communities and regions
- ☐ Category 2: Green Infrastructure Jobs Analysis
- X Category 3: Utilizing Green Infrastructure to Manage and Mitigate Stormwater to Improve Water Quality

PROJECT CONTACT NAME, ORGANIZATION, ADDRESS, PHONE NUMBER, FAX NUMBER AND EMAIL ADDRESS:

Igor Lacan, Urban Forestry Advisor
University Of California Cooperative Extension
80 Stone Pine Road, #100
Half Moon Bay, CA 94019
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ilacan@ucanr.edu

PROJECT TITLE:
Monitoring tree survival and performance in street-side stormwater management facilities

FUNDING REQUEST AND MATCH (Note: Matching amount must at a minimum equal requested amount.)

REQUESTED: $ + MATCHING: $ = TOTAL PROJECT: $

$37,032+$37,032=$74,064

OUTREACH:

Note: if one check "Yes" in either of the boxes below, the applicant will be required to describe either how they plan to outreach to the identified population and/or provide a description of your underserved organization.

Is this project being developed to reach a minority or underserved population?
___Yes __x_No

Is this pre-proposal being submitted by a minority or underserved population (owned/operated/directed) business, organization or college/university? ___Yes __x_No

Applicants should also address how the issue impacts underserved communities and how the proposal can address or minimize these impacts when applicable.

LIST PROJECT PARTNERS: Project Partner letters are to describe their role and contribution with the project.

1. City of San Jose, CA. Ralph Mize, City Arborist.
   Department of Transportation, 1404 Mabury Rd., San Jose, CA 95133
   (408) 794-1915. Ralph.Mize@sanjoseca.gov
2. City of San Jose, CA – Landscape Maintenance Districts.
   Dorothy Abeyta, Special Districts Manager.
   Department of Transportation, 1404 Mabury Rd., San Jose, CA 95133
   (408) 794-1924. Dorothy.Abeyta@sanjoseca.gov
3. City of San Francisco: Mei Ling Hui, Urban Forest Coordinator.
   Dept. of the Environment, 1455 Market St., #1200, San Francisco, CA 94103
   (415) 355-3731 Meiling.hui@sfgov.org
4. City of El Cerrito, CA. Stephen Pree, City Arborist.
   Public Works Department, 10890 San Pablo Ave., El Cerrito, CA 94530
   (510) 215-4333. Spree@ci.el-cerrito.ca.us
5. City of Portland, OR. Jennifer Karps, Urban Tree Canopy Program Coordinator.
   Portland Environmental Services, 1120 SW 5th Ave., #1000. Portland, OR 97204
   (503) 823-2263. Jennifer.karps@portlandoregon.gov

LIST STAKEHOLDER SUPPORT: Support letters from stakeholders are to describe why the proposal end results are needed and how it will benefit them and their community.

[Provide: NAME, ADDRESS Phone Number and Email:]

LETTER OF SUPPORT INCLUDED: ___YES _x__ NO

1.
2.
3.

ABSTRACT: Summarize the proposed project in 200 words or less.

Street-side stormwater infiltration basins ("stormwater facilities") planted with vegetation that often includes ornamental trees are becoming increasingly common. However, little is known about the performance of trees – survival, growth, and health/pests – planted therein. This project evaluates tree survival, growth, and condition in stormwater facilities, over period of three years, with street trees of the same species and comparable age used as controls. We use the city of Portland, OR (>10 years experience with trees in stormwater facilities) as a long-term comparison for three cities in the San Francisco Bay Area (San Francisco, San Jose, El Cerrito; 0-4 years experience). Study will result in two products: a publication, and a monitoring protocol. Study results will be presented in a peer-reviewed article, trade journal article, and a webinar. The study results will also be used to construct a standardized monitoring protocol for trees in stormwater facilities, to be used by cities that are installing their own stormwater facilities. The protocol will be informed by the study results as well as the suggestions from partner cities, and will include instructions, data collection templates and calculation sheets, as well as a discussion of lessons learned in this study.

Proposal Narrative Template:

1. Project Description (20 points), only one category may be selected per submission:

Street-side stormwater infiltration basins (differing in construction and known variously as, "bioswales," "green streets" or "public right-of-way infiltration facilities") planted with vegetation that often includes ornamental trees, are becoming an increasingly common strategy for stormwater management in cities. However, little is known about performance of trees – their survival, growth, and health condition or pest damage – in these facilities. This project aims to evaluate trees in stormwater facilities of different age, with a focus on street-side infiltration basins as the most common type of facility (and the one most likely to be associated with street trees).

Methods: We will measure tree attributes over a three-year period, and compare the trees planted in stormwater facilities with trees of the same species and age planted as street trees. Tree size (DBH, height, crown size), condition (crown ratio; crown opacity; twig elongation, foliar and trunk defects) will be assessed, and presence of any pests (insects or pathogens) will be noted. Soil conditions will be assessed as well (soil structure; texture; waterlogging) and soil samples will be sent for comprehensive analysis of parameters pertinent for tree growth (soil macro- and micro-nutrients; salinity, sodicity).

Study sites are located in the San Francisco Bay Area, and span cities of differing

densities (San Francisco, El Cerrito, San Jose) and with stormwater facilities of different age, as old as 4 years (El Cerrito), to current installations (San Jose). We will use the City of Portland, Oregon (where some stormwater facilities are over 10 years old) to enable us to make inferences regarding long-term performance of trees in stormwater facilities. While the climate of Portland differs considerably from that of the San Francisco Bay Area, we note that this difference – although limiting our direct Bay Area-to-Portland comparisons – will make the study applicable to a large portion of the United States (continental US, excepting perhaps subtropical climates and northern regions with heavy applications of de-icing road salt). Because much of the climatic difference is likely to manifest itself as water stress, we will continuously monitor the soil water conditions using soil moisture sensors linked to dataloggers.
At the conclusion of the study we will calculate survival of the trees in the stormwater facilities, and will compare survival rates as well as condition score to those of the street trees. The cities were selected in part because they have active street tree-planting programs with reasonably well-kept planting and tree-replacement records, which will be useful in final calculations.

2. Originality and Innovation (5 points):

This study is unique and pioneering in its focus on the survival and condition of trees in green infrastructure facilities. Design of stormwater facilities has been focused on optimizing the intended function of each facility (stormwater collection, detention, and infiltration or delayed discharge), and while the role of planted vegetation in the stormwater processing is widely recognized, the appropriate condition of that vegetation – living, growing, and mostly free of pests, diseases and environmental damage – has been presumed, rather than evaluated. Unsurprisingly, quantitative information on tree survival and condition in stormwater facilities is unavailable, and no monitoring protocol exists that would guide those municipal arborists and stormwater managers who wish to begin to evaluate their own stormwater facilities.

3. Literature Review (5 points):

To my knowledge, no studies have been published thus far on survival, growth, and condition of trees in green infrastructure facilities. The available stormwater literature focuses on evaluating the performance of such facilities (i.e., pollutant removal; stormwater residence time; etc.) or on documenting the physical impediments to optimizing stormwater handling (e.g., issues such as siltation; overflow; etc.), and is thus

largely tangential to the goals of this study.

For this study, the pertinent literature examines the condition, growth, and mortality of urban trees. These topics have been evaluated in the past, and the relevant studies include the early work by Richards on street tree populations (1979, 1983); assessments of growth and mortality by Nowak and colleagues (1990, 2004), by Miller and Miller (1991), and recently by Lawrence and colleagues (2011) Regarding mortality, I highlight the recent work by Roman and colleagues (Roman and Scatena, 2011; Roman et al., 2013) which forms the basis of the demographic analysis used in this study. On tree condition, I am relying on the method described by Bond (2012), which in turn is informed not only by the work of arborists and tree physiologists, but also by the work of USDA Forest Service researchers on both the individual-tree-scale (e.g., i-TREE protocols) and the city- and forest-scale (e.g., McPherson 1993; Cumming et al. 2008).

Abridged bibliography

Bond, J. 2012. Urban Tree Health: A Practical and Precise Estimation Method. Urban Forest Analytics and the International Society of Arboriculture.

Cumming AB, Twardus DB, Nowak DJ. 2008. Urban forest health monitoring: large-scale assessments in the United States. Arboriculture and Urban Forestry 34:341–346.

Lawrence AB, Escobedo FJ, Staudhammer CL, Zipperer W. 2011. Analyzing growth and mortality in a subtropical urban forest ecosystem. Landscape and Urban Planning 104:85–94.

McPherson EG. 1993. Monitoring urban forest health. Environmental Monitoring and Assessment 26:165–174.

Miller RG, Miller RW. 1991. Planting survival of selected street tree taxa. Journal of Arboriculture 17:185–191.

Nowak DJ, McBride JR, Beatty RA. 1990. Newly planted street tree growth and mortality. Journal of Arboriculture 16:124–129.

Nowak DJ, Kuroda MK, Crane DE. 2004. Tree mortality rates and tree population projections in Baltimore, Maryland, USA. Urban Forestry Urban Greening 2:139–147.

Richards NA. 1979. Modeling survival and consequent replacement needs in a street tree population. Journal of Arboriculture 5:251–255

Richards NA. 1983. Diversity and stability in a street tree population. Urban Ecology 7:159–171.

Roman LA, Scatena FN. 2011. Street tree survival rates: meta-analysis of previous studies and application to a field survey in Philadelphia, PA, USA. Urban Forestry and Urban Greening. 10:269–274.

4. Project planning and timeline (10 points):

~ September 2015: Begin study; purchase equipment; select sites in Portland, San Francisco, El Cerrito, and San Jose. Initial tree condition measurements; begin sensor installation; first soil sampling.
~ November 2015 (Portland and Bay Area): verify sensor operation and adjust/replace as necessary.
~ April 2016 (Bay Area): tree condition measurements.
~ September 2016 (Portland and Bay Area): Tree condition measurements; second soil sampling; verify sensor operation, download data, adjust/replace as necessary.
~ April 2017 (Bay Area): tree condition measurements.
~ September 2017: (Portland and Bay Area); Tree condition measurements; third soil sampling; verify sensor operation, download data, adjust/replace as necessary.
~ April 2018 (Bay Area): tree condition measurements.
~ September 2018: (Portland and Bay Area); Tree condition measurements; fourth soil sampling; download sensor data, remove sensors (Portland).
~ April 2019 (Bay Area): tree condition measurements; download sensor data, remove sensors.
~ April-May 2019: data analysis and manuscript and monitoring protocol preparation.
~ June-September 2019: Results webinar; submission of manuscript for publication consideration; evaluation report submission to NUCFAC; monitoring protocol posted on website; results presented at conferences.
~ September 2019: study ends. Manuscript and monitoring protocol, as well as the archived webinar, will remain accessible on the UC website free of charge.

5. Product (10 points):

Two products will result from this study. The first product will be our assessment of tree survival, condition, problems and growth rates of trees in street-side stormwater facilities. The assessment will be published as a peer-reviewed journal article, as well as an abridged version focusing on "lessons learned," published in a trade magazine. A webinar will be held at the conclusion of the project, with participation from the partnering cities to discuss results, and will be archived on the UC website.
The second product will be a protocol for monitoring trees in stormwater facilities. Developed in collaboration with the project partners, and based on the "lessons learned" during the study, the protocol will be a comprehensive guide for municipalities who are interested in monitoring their own stormwater facilities. The protocol will include templates for data collection, and excel files with pre-

programmed calculations (to enable calculation of survival rates, and for comparison of tree condition to neighboring street trees).

6. Collaboration (15 points):

We have partnered with four cities on this project: three in California (San Francisco, San Jose, El Cerrito), and Portland, Oregon. The cities represent a gradient of experience with stormwater facilities, from a national leader (Portland) to a relative novice (San Jose), and reflect well a diversity of incomes, building and tree densities, and climates.

Partner roles: the city staff from the partner cities will assist in finding suitable stormwater facilities, in finding comparable street trees, and in obtaining public records pertaining to planting/removal of the street- and stormwater-facility-trees. The partner staff will receive regular (quarterly) updates via e-mail about the project, and will be invited to provide comments at each update. At the conclusion of the study, the city staff will be invited to participate in the webinar on lessons learned.

I note that the limited role for partner cities reflects the reality of uncertain municipal budgets, and the considerable staff turnover that may occur over the four years of the study. The study is, however, designed so that additional sampling sites may be incorporated should local funds or staff time become available during the study.

7. National Distribution/Technology Transfer of Your Findings (10 Points):

Study findings will be presented at three conferences, with a view towards informing the professional audience. One will be an international conference such as the meeting of the Society of Municipal Arborists, or the International Society of Arboriculture. The second will be a large regional conference, such as the meeting of the Western Chapter of the International Society of Arboriculture (such a meeting is more likely to attract the operations-level municipal staff, who are critical to managing stormwater facilities, but might not be approved to travel to an "international" conference).

Third, I will also present at a national-level conference focused on planning or architecture (e.g., American Planning Association, American Society of Landscape Architects), to reach the planning and design community.

Fourth, as suggested by the reviewers, I will present the results at a national meeting of green infrastructure professionals, e.g., the American Public Works Association (APWA) Annual Conference.

To inform the research community, the study will be published in a peer-reviewed journal, and manuscript provided to USDA Forest Service.

Finally, to reach an even wider audience, we will hold a webinar to both discuss the lessons learned, and to introduce the tree monitoring protocol (which will be available on the UC website, free of charge, and will be provided to USDA Forest Service).

8. Project Evaluation (10 points):

Project will be evaluated in two different and novel ways, in addition to including a "typical" discussion of the project challenges (and shortcomings) in the published journal article. First, we will use the webinar to focus discussion on evaluating the project itself (as well as discussing the operational lessons that were learned). Because the project partners will have been provided with preliminary study results prior to the webinar, they will be able to comment on the usefulness of the project to their operations, and on their own level of knowledge (regarding tree survival in stormwater facilities) prior to and following the study.

The second means of project evaluation will be the monitoring protocol itself, developed as one of the study products. In the protocol, we will discuss the challenges we encountered during the study, and note the shortcomings of our own monitoring work that were the result of those challenges. As an appendix to the monitoring protocol, we will collate the comments from the webinar regarding the most (and least) useful elements of the study, as another guide to municipal managers starting up their own monitoring program.

All of the project evaluation notes and materials will be provided to the USDA Forest Service at the conclusion of the study.

9. Experience/Personnel/Adequacy of Resources (5 points):

The principal investigator, Igor Lacan, is a Cooperative Extension Advisor for Urban Forestry in the San Francisco Bay Area (CV included in the Appendix). Igor has worked in urban forestry research for over a decade, with multiple publications in peer-reviewed literature and trade journals. He has also worked with all of the partner cities, and is familiar with urban forest management across the San Francisco Bay Area (where he obtained his graduate degree, and worked as an urban forestry consultant) as well as in Portland where he served on the Urban Forestry Commission (in 2013). The partner cities, while varying in their experience with stormwater infrastructure, nevertheless all have substantial experience with urban forestry (including tree planting/removal records), and have participated in urban forestry studies in the past and are committed to the success of this project.

The principal investigator has access to the academic resources of the University of California, including literature, IT support (esp. important for the webinar component), and expert colleagues in environmental horticulture.

10. Budget Justification (10 points):

The two main expenses for this project include travel to Portland and around the San Francisco Bay Area, and the expenses related to soil monitoring (sensors, dataloggers, and laboratory tests). The travel budget for the principal investigator is necessary, as the

partner cities have clearly indicated that they do not have the capacity to commit staff time to the study. The soil monitoring element is necessary as it will enable us to evaluate the major climatic difference among the cities, and will allow us to interpret the results to make them applicable to a broader national audience.

	Federal Funds requested	Non-federal match	Total	Source of Matching Funds
Personnel*	0	$20,524	$20,524	Univ. of California
Fringe benefits (43.2%)	0	$8,866	$8,866	Univ. of California
Equipment**	$4,800		$4,800	
Field supplies***	$4,700		$4,700	
Lab fees""	$8,000		$8,000	
Travel to/lodging in Portland^	$4,000		$4,000	
Travel around SF Bay Area^^	$2,700		$2,700	
Meeting travel^^^	$4,700		$4,700	
Manuscript prep./pub.; webinar preparation	$490		$490	
Indirect costs (26%)	$7642	$7642	$15,284	Univ. of California
	Total requested **$37,032**	Total match **$37,032**	Total **$74,064**	

Explanations:
* 7% of time of the project investigator, for four years, at $74000/yr
** Soil sensors and dataloggers (40 sites * $120/site)
*** Consumables for sensors (40 sites * $50/site * 2 likely replacements); supplies for soil sampling ($700)
"" Lab fees for soil testing (40 sites, 4 samples/site; $50/sample)
^ Five field sampling visits (at 0, 3, 12, 24, and 36 months) of three-four days each, $800/visit (airfare; lodging; mileage in Portland; perdiem)
^^ An average of eight siting/sampling visits to each of 20 sites; average roundtrip of 30 miles; 55 cents/mile
^^^ Travel for one person to three conferences to present results (one regional; three national: one on urban forestry, second conference focusing on planners, and the third conference focusing on green infrastructure professionals)