Project Description & Articulation of Benefits

The increased urbanization and habitat degradation has had negative impacts on many native species of bees (Goulson 2010; Xerces Society 2017a). As a result, there is an increasing need for the development of bee-friendly habitat within urbanized areas. The objective of this project is to refurbish underutilized garden beds on the TRU campus into a "Bee-happy Garden." This project will result in both the creation of pollinator habitat and provide unique educational opportunities for both TRU and Eureka Science Camp students.

Globally there are 25,000 known species of bees (Goulson 2010). Although many recognize the honey bee as an iconic symbol of pollination, this species is not actually native to North America (Westerndorp 2001). Native bees make up an integral component of the ecosystems which they inhabit. Notably, bees reside in a group of pollinators who are responsible for 75% of the world's flowering plant production (IUCN 2017). In BC, the Thompson-Okanagan region is well-known for supporting a unique assemblage of native bees (Lincoln Best, personal communication). The city of Kamloops is BC's First Bee Friendly City. The city has been awarded this title because it has identified the importance of habitat conservation in attracting bees; yet, urban landscapes within Kamloops vary greatly in the quality of bee habitat that they provide (A. Battel, B.Sc honours thesis, in progress).

Conservation efforts always have to start with awareness. The creation of a Bee-Happy Garden on campus will create the opportunity for students, youth, and Kamloops citizens to familiarize themselves with the diversity of shapes, colors, sizes and lifestyles of our native bees. Specifically, this project seeks to refurbish garden beds surrounding the Ken Lepin Science building with native and horticultural species known to be beneficial for native bees. The beds referred to in this proposal are the Science Beds #15, 17-21 located on southwest side of the building between the Science Building and the Gymnasium (Figure 1 and 2).

The revitalization of these garden beds into a space where native bees can feed, nest, and seek shelter will not only provide much needed habitat for these species but will also act as a model for more eco-inclusive landscaping choices on campus. In addition, the transformation of these beds into pollinator habitat will create a living laboratory that can mitigate some of the current need to travel off-campus to observe native plant and pollinator populations. Finally, we believe the creation of these beds will help build an understanding of bee populations in Kamloops, which is especially important as the conservation of bees has been impeded by a lack of information (Cameron et al. 2011).

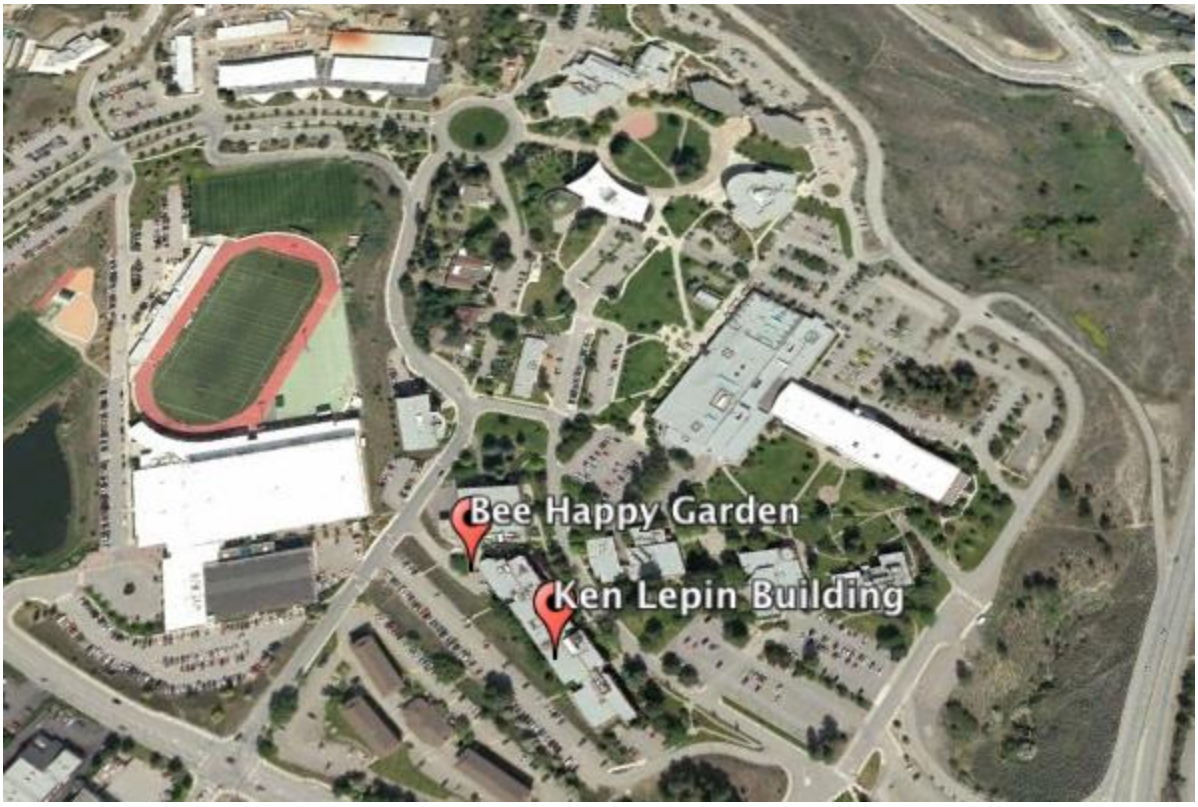

Figure 1: Proposed location for the Bee Happy Garden.


Figure 2. Photo of the garden beds, currently covered in snow, located behind the benches.

People, Partnerships, and Performance Measurement

This project is a collaboration of the TRUSU Eco Club, Faculty of Science, and the EUReKA Science program. In developing this proposal, we have consulted with the TRU Facilities (Warren Asuchak, Cameron Lindsey), the TRU Horticulture Program (Kevin Scollon, Ernest Phillips), as well as members of the TRU Landscape Advisory Board (Peggy Broad, Cameron Lindsey, Kevin Scollon, and Ernest Phillips). In short, this proposal has broad support from all of the above departments.

Developing these beds will occur in two separate stages:

Stage 1

Initial bed preparation, garden design and planting: If approved, bed preparation will occur through a collaboration of students currently enrolled in Biol 3430, (Plants and People) that include Biology, Arts, and Horticulture students and TRUSU ECO members in early April. This bed preparation will be overseen by Lyn Baldwin, with support and advice from Cameron Lindsey and faculty from Horticulture. The involvement of Horticulture students already well-versed in the use of gardening/landscaping equipment will facilitate this project's use of university equipment (K. Scollon, personal communication). While initial planting may occur in April, much of the garden design and planting will be done by an undergraduate research assistant who be directly supervised by Lyn Baldwin. The undergraduate research assistant will also research and design interpretative signs that will highlight the conservation value of these garden beds.

Stage 2

Ongoing refurbishment and maintenance: No garden is static. Winter mortality as well as human disturbance will necessitate this garden's ongoing refurbishment, including the propagation of replacement plants. This will occur as part of the education programming in at least three upper-level botany courses (Biol 3430, BIOL 3260 and Biol 4120) which are taught in the Winter Semester. As these are already established (albeit, under-planted) garden beds on campus, regular maintenance of the beds will be incorporated into normal Groundskeeping facilities (Cameron Lindsey, personal communication).

Once established, these beds will be available for a wide variety of educational activities in both the EUReKA! Science Program and in the Department of Biological Sciences.

Lyn Baldwin will coordinate activities in upper level botany classes in Biological Sciences

Kathryn Haegedorn, current director of Eureka Science camp will coordinate incorporation of activities into camp activities and will facilitate training of Eureka instructors. In addition, Verlinda Wale, Coordinator for the Faculty of Science, oversees the Eureka program and will be able to help ensure that future EUReKA! directors and instructors remain aware of the instructional opportunities of this pollinator garden in future years. The TRUSU Eco Club is also excited to contribute and be a part of the growth of this project in years to come. A full list of project members has been provided in Appendix I.

Given that this project is meant to provide direct educational and ecological benefits, measurement of project performance will be through its integration into learning activities associated with both EUReKA! and the Department of Biological Sciences. In addition, we anticipate the incorporation of monitoring activities in EUReKA! programs (through citizen science protocols) will provide data on this project's ecological performance. Although less easily assessed, we also anticipate that revitalization of these garden beds will enhance the enjoyment of this space for all students--many of whom currently pass through (or over) these garden beds without pause.

Level of Impact

General Student Involvement

This project began when the TRUSU ECO Club started pursuing their hope to see more educational green spaces incorporated on the TRU campus. Much of the project's implementation will be by a summer Undergraduate Research Assistant and there will be many more opportunities for student engagement in years to come.

Given Kamloops' seasonal climate, most flowering plants in our area have gone dormant by the time student's return for fall courses. However, recent research in Kamloops (Aneka Battel, B.Sc. honours thesis, in progress) has documented that many pollinators remain abundant and active throughout September, some even into October, in garden beds with irrigation. Thus the development of a pollinator-friendly garden on campus will enable us to develop laboratory exercises currently impossible. Urban gardens for the maintenance of native pollinator populations is an area of increasing research and these garden beds will provide an important opportunity for student research. The potential of these beds to impact students in the EUReKA! Summer science camp cannot be understated. Certainly, the development of a Bee Happy Garden will allow staff members of EUReKA! (all university students) to develop summer programming with the Bee Happy Garden for children. (See Educational Opportunities)

Undergraduate Research Assistant

A student will be hired part-time as a summer undergraduate research assistant (as per Letter of Understanding between TRU-CUPE) for the summer of 2018 in order to plant the bee-happy garden beds and create a seed bank to provide for future refurbishment of the garden. This part-time position will include designing, implementing and maintaining the garden, as well as researching and creating a native seed bank. The student will also research and design educational signage for the garden to facilitate awareness of the project. The research assistant will receive comprehensive training on native bees including identification, habitat needs, life history, and preferred plant species. The student will be hired through a committee, and applications will be accepted from TRU students. Pay for the student has been accounted for in the budget. In addition, they will receive close guidance from Dr. Lyn Baldwin over the duration of the summer to ensure they have sufficient knowledge to meet the gardens needs.

Educational Opportunities

The nature of the space encompassed by these beds, soon to be transformed into a vibrant bee-happy garden, will create an attractive and relaxing space for both casual use and educational programming. The project will link directly into current curriculum and benefit the EUReKA! Science Program. Educational signage will also ensure that anyone passing by can learn from the garden.

The EUReKA! Science Program, held on TRU campus every summer runs for eight weeks, and reaches approximately 800 youth. As the Bee Happy Garden will be located next to the science building, where the EUReKA! Camps are based, the campers will have the opportunity to learn about the ecological benefits of native plants and the important role bees play in the environment. Youth aged 11-13 that attend the camp will participate in a week long project in which they will maintain the garden and learn to identify and distinguish bee species.

The development of pollinator-friendly garden beds will provide a living laboratory for direct observation of plant-pollinator interactions as well as the plants themselves. This garden will provide an opportunity for TRU students to complete independent research projects as Directed

Studies/Honours Theses, and will support educational programing in botany-focused courses such as Biol 2280 (Evolution of Land Plants), Biol 3260 (Field Botany), Biol 4120 (Evolution of Flowers), and Biol 3430 (Plants and People). The instructor of these courses, Dr. Lyn Baldwin, welcomes the opportunity for students in these courses to contribute to the maintenance of this garden. Additional courses that could benefit from the garden are Biol 2170 (Introduction to Ecology), Biol 4160 (Conservation Biology) and NRSC 4020 (Entomology).

Overall, the transformation of these garden beds into an area brimming with scientific opportunity as well as beauty will encourage citizen science, stimulate more in-depth interaction with the natural spaces, and hopefully encourage broader awareness about environmental conservation.

The Garden and TRU's Strategic Planning

Our proposed project aligns with many of the goals put forward by the Campus Strategic Sustainability Plan. The proposed garden will promote the sustainability image that TRU is looking for, as well as the garden has strong linkages to ecology curriculum, and will be a place in which research can occur, which aligns with strategic recommendations three and four. The Bee Happy garden aligns strongly with the objectives set forth by section 4.3, Campus Grounds. The garden will create "soft landscapes" that are reflective of local ecology; it will celebrate local species and inform students through plant identification signs, and encourage biodiversity through creating habitat for native bees. Section 6.1 Curriculum states the desire to create on campus a "living laboratory", and this garden will enable experiential learning and research in biology classes, the Eureka program, and through independent research projects completed by students.

The Bee Happy Garden also aligns with many of the goals outlined within the Campus Master Plan. According to the Campus Master Plan (2013) section 3.3.6 Outdoor Research and Teaching Spaces, it is important that learning occur inside and outside, and native grasses and plant life are valued for their research capacity and through the creation of an outdoor lab. The Bee Happy Garden will support this objective by increasing outdoor learning spaces on campus. Section 3.5.4 Environmental Stewardship explains a desire for "the use of more native and edible plants in low maintenance, simple landscaping scheme", and a pesticide-free campus, both of which the bee garden will provide.

Project Feasibility

Our team consists of a diverse group of students, staff, and faculty, whose combined experience makes a diverse portfolio perfectly adept at collaborating on all angles of this project. Efforts have gone into reaching out to appropriate TRU staff to collaborate with this project. The support from these TRU Staff will help us achieve cost-effectiveness compared to the alternative of hiring consultants to achieve the same outcome.

$2150 is requested to hire a part-time summer student. This cost covers the student's wage and an additional 12% benefits is factored into the hourly wage. This student will be hired to work eight hours per week, over a twelve-week period, with a compensation of twenty dollars an hour (plus 12% benefits). As mentioned above, this student will be responsible for the preliminary development of the garden. Dr. Lyn Baldwin's Plants and People course (Biol 3430) will also help with the start of the site preparation. An essential function of the groundwork of the garden is picking up the plants and continuous seed collecting (in the field) over the duration of the twelve weeks to establish a seed bank. It has been estimated that the mileage to travel to the nursery,

Splitrock Environmental, located in Lillooet B.C. (169 km from Kamloops B.C.) will cost approximately $85, based on the guidelines set by TRU private vehicle and mileage rates – $0.50 per km. Over the course of the work-term, this student will be responsible for collecting native seeds in the Kamloops area, thus will require mileage reimbursement, estimated at 60 km per week, totaling $360. The estimated cost of the plants is $1500.

Gardening materials and supplies are available within the University by the TRU groundskeeping. Cameron Lindsay is contributing use of TRU tools and soil for the bed preparation. The beds are already under irrigation, therefore no additional costs for an irrigation system is needed, except for a hose and nozzle ($70). The need and types of fertilizer and other soil amendments will be considered once the garden design is created, therefore $200 has been allocated in the budget. Expertise from biology and horticulture students enrolled in Biol 3430 and the Eco Club will be contributing to the planting practices, as well as Kevin Scollon who will also provide important expertise. Seed storage will be kept in the Herbarium, located in the Ken Lepin Building; $400 has been allocated to creating the appropriate seed storage system. Educational signage is estimated to cost $700.

Our proposed project is modest in size with the intention that it be easy to implement and not become overwhelming in scale. As ecological landscaping can be beneficial in many areas it is our hope that this garden will inspire conversation and action towards ecologically friendly landscaping and, that this project's small size, will be inspiration for similar projects on campus.

If this project receives funding the process of hiring a part-time summer student will commence immediately. With a smooth hiring process the student will be available to begin planting in spring/early summer and will have the rest of the summer to collect seed for subsequent years as well as nurture the beds into the fully functioning mini-ecosystem we imagine. This project has been constructed and supported so that, following initial installation, it will become a low maintenance area that has the potential to properly function as long as the space remains intact.

With this area's easily accessible location we forecast that students, staff, faculty, educational groups, and the Kamloops community as a whole will all have the opportunity to benefit from this space.

Bee Happy Garden Budget				
Application Number:	**Column A**	**Column B**	**Column C**	**Comments**
EXPENDITURES (Round to nearest dollar)	**Total project cost**	**Amount of project cost supplied by applicants**	**Amount in Column A requested from the Sustainability Grant Fund**	**Explain how the total costs in Column A were derived at (attach additional documents if needed)**
Labour Costs				
Consultants/Professional Fees	$0		$0	Students from Biol 3430
Summer student	$2,150		$2,150	8 hr per week ($20 per hr + 12% benefit pay) for 12 weeks
Volunteer Honourariums	$0		$0	
Other (specify):				
Summer student education	$100		$100	
Fees Sub-total:	**$2,250**	**$0**	**$2,250**	
Direct Costs				
Site/bed Preparation	$0		$0	Students: Biol 3430 & TRU Eco Club
Soil & Gardening tools and equipment	$0		$0	In-kind support from TRU Groundskeeping
Plant Costs	$1,500		$1,500	Split Rock Environmental
Seed Storage	$400		$400	On-Campus Herbarium
Fertilizer	$200		$200	
Irrigation accessories	$70		$70	Hose & Nozzel
Direct Costs Sub-total:	**$2,170**	**$0**	**$2,170**	
Communications or Training				
Travel to Collect Seeds	$360		$360	60 km per week at $0.50/km
Travel to Nursery (plant pick-up)	$85		$85	169 km at $0.50/km
Training or Educational Materials	$700		$700	Interactive Signage
Brochures or program notes				
Pre-printing including design, layout				
Printing/copying				
Web site/Social Media sites design/production				
Marketing, publicity and promotion				
Other (specify):				
Communications Sub-total:	**$1,145**	**$0**	**$1,145**	
Overhead				
Overhead Sub-total:	**$0**	**$0**	**$0**	
ADD ALL SUB-TOTALS	**$5,565**	**$0**	**$5,565**	
Contingency Amount (please include 10% of the Sub-Total as a contingency amount):	**$556**	**$0**	**$556**	
TOTAL OF ALL COLUMNS	**$6,121**	**$0**	**$6,121**	

Planning

In developing this proposal, we have consulted with the TRU Horticulture Program (Kevin Scollon), TRU Facilities (Warren Asuchak, Cameron Lindsey) as well as members of the TRU Landscape Advisory Board (Peggy Broad, Cameron Lindsey, Kevin Scollon, and Ernest Phillips). As stated above, this proposal has broad support from all the above departments (see Appendix 2 for Letter of Support from the Ernest Phillips, Chair of the TRU Landscape Advisory Board). Permission to use these beds as a Bee Happy Garden has already been secured from Cameron Lindsey, Heads Groundskeeper at TRU, as advised by Warren Asuchak, Director of Facilities.

Obviously, as co-proponents of this proposal, Valerie Law (President TRUSU Eco Club), Dr. Lyn Baldwin (Faculty, Biological Sciences), Kathryn Haegedorn (Director, Eureka Science Camp), and Verlinda Wale (Coordinator, Faculty of Science) have agreed to the involvement of their respective courses or programs in this project. In addition, TRU Horticulture has already provided expert advice in planting practices and Cameron Lindsey (TRU Head Groundskeeper) has committed to providing the necessary tools and soil for bed preparation as well as planting advice.

The primary costs for this project are one-time, especially as we have outlined a mechanism for ongoing cultivation of plants and refurbishment (i.e. establishment of existing seed bank and cultivation of replacement plants as part of course activities) Thus, we have not included a ongoing yearly budget.

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Appendix I

Team Members

TRUSU Eco Club

Valerie Law - President of the TRU Eco Club and project proponent. Valerie is a Natural Resource Science student who has a keen interest in sustainability and conservation. She has previously secured grants to pursue research on mitigating the impacts of invasive European grey squirrels, is currently concluding a project which investigated positive ways to provide refuge for snakes in vineyards, and is presently undertaking a project on the TRU campus that focuses on engaging students in sustainable drinkware practices.

Yuma Baker - Editor for this proposal, Eco Club member and student currently planning to major in Ecology and Environmental Studies. Yuma has a great love for gardening and bringing awareness to native flora and fauna.

Hanna Martens - Member of the Eco club, and a student studying geography/environmental studies and political science. Hanna has a passion for gardening and the environment. She is currently working on securing funding for research on gardens and their impact on environmentally friendly behavior, and spent her past summer teaching children about gardening and why it is important at a summer camp.

Chanel Gagnon- TRU Eco Club member and Natural Resource Science Student. Chanel has an interest in stewardship, conservation and environmental education. She has collaborated on grant applications to pursue educational conferences and has secured funding through NSERC on researching mitigating apical dominance in crane-pruned Merlot grapevines.

Faculty of Science

Dr. Lyn Baldwin - Associate Professor, Department of Biological Sciences. Lyn is trained as a field botanist/ecologist and has supervised numerous summer research students including Directed Studies, Honors, and UREAP students. Most recently, Lyn's research portfolio has been investigating the plant ecology of urban gardens, including their value for BC's native bees. Lyn has established a close working relationship with the Thompson-Shuswap Master Gardens and has assisted (and participated in) their native bee, citizen science monitoring program. Lyn will provide oversight of the development and initial maintenance of the gardens as well as help facilitate educational use of the garden in TRU courses.

Eureka Science Camp

Katheryn Haegedorn - Director of EUReKA! Science Camp, Eco Club member, and a fourth year biology student interesting in promoting environmental awareness and educational opportunities to youth. Katheryn has been instrumental in writing this grant and will facilitate EUReKA! Science Camp instructor awareness and potential use of the Bee Happy garden in their educational programming.

Verlinda Wale- Academic and Administrative Coordinator for the Faculty of Science. Interested in the project to promote sustainable and environmental projects to be used for educational purposes. As coordinator, Verlinda oversees the Eureka! Science program and will help ensure that Eureka instructors remain cognizant of its potential use in educational programming.

Appendix II

Letter of Support from Ernest Phillips, Chair Landscape Advisory Board (sent via email to Dr. Lyn Baldwin).

February 4, 2018

TRU Eco Club
c/o Dr. Lyn Baldwin, Faculty of Science
Thompson Rivers University
Kamloops, BC, V2C 0C8

Dear Lyn:

I am pleased to offer support to the TRU Eco Club and the 'Bee Happy Garden Beds Project' on behalf of the TRU Landscape Advisory Committee. We are in complete support of the application to obtain sustainability grant funding.

It's great to see such innovative student initiatives that will serve to enhance the TRU landscape with naturalized and more sustainable garden areas. This type of garden will provide opportunities for educational support of various courses within the existing science and horticulture programs.

We wish the TRU Eco Club every success in their application and project endeavours.

Sincerely,

Ernest Phillips, Chairperson
TRU Landscape Advisory Committee