

University of British Columbia

Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Biodiversity Engagement: Accessible Language and Strategies

Stimulating Community Engagement in Biodiversity Conservation within the University of British Columbia Vancouver Campus

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1. Abstract

Although communities' actions do not always reflect people's knowledge over the repercussions of climate change, most are well aware of the need to reduce carbon emission. On the other hand, biodiversity, which is mutually reinforced with climate change and is at the highest risk of irreversibility according to the planetary boundary, has not been given proportional awareness among the general public as compared to the urge of carbon emission mitigation. The reason being is very likely due to the complexity of the biodiversity concept and difficulty to communicate this issue to the general public. Given that most remain unaware of the significance of biodiversity conservation, in consultation with UBC's Social Ecological Economic Development Studies (SEEDS) Sustainability Program, this paper is prepared to suggest potentials to raise biodiversity awareness and changing community behaviour in the Vancouver campus of the University of British Columbia (UBC). In order to find out potential solutions for raising biodiversity awareness on campus, a definition of "Biodiversity" and research over communication challenges of biodiversity conservation will be further elaborated in the paper along with a list of recommendations to develop strategies to engage community members with biodiversity conservation.

2. Introduction

Similar to climate change, biodiversity is being jeopardised by human-induced global shifts. Overexploitation of natural resources, human-wildlife conflicts, and ecosystem damage are all immediate causes of biodiversity loss. The increase in carbon concentration and positive feedback loop effects derived from climate change also contribute to long-term danger to biodiversity.

Dr Robert Bloomfield, proposed that the easily communicated nature of climate change and the complex narrative that often require different responses when communicating the idea of biodiversity is the reason behind lack of understanding in biodiversity conservation (Vaughan., 2010). For such, even though biodiversity loss is interrelated to climate change, the concept is often not well communicated or understood by people outside of academia. Consequently, although the general public have become more aware of the influence of climate change and the urge to decrease carbon emission, there is a huge lack of understanding of biodiversity challenges and its significance.

The planetary boundary concept, which explains the environmental limits where humanity could operate safely, implies that biodiversity has not been paid awareness that is proportional to its importance (Steffen et al., 2015). This could be supported by the visual diagrams in Figure 1. which depicts that the rate of biodiversity loss is of greatest concern to be pushed to a new state among all nine proposed planetary boundaries (Rockström et al., 2009). Nevertheless, the significance of biodiversity awareness remains hard to communicate given that species richness and extinction rate can feel disconnected from human needs (Mace et al., 2014). Rockstrom et al. (2009) proposed that the boundary for biodiversity loss is especially hard to analyse because of the difficulties in quantifying the thresholds and the limited knowledge we have about biodiversity's role across scales in the ecosystem. Moreover, the lack of data to support and a relatively complex planetary boundary diagram that is not widely spread leads to people's ignorance of the biodiversity crisis. That being the case, finding solutions to engage the community to be more aware of the biodiversity crisis is essential.

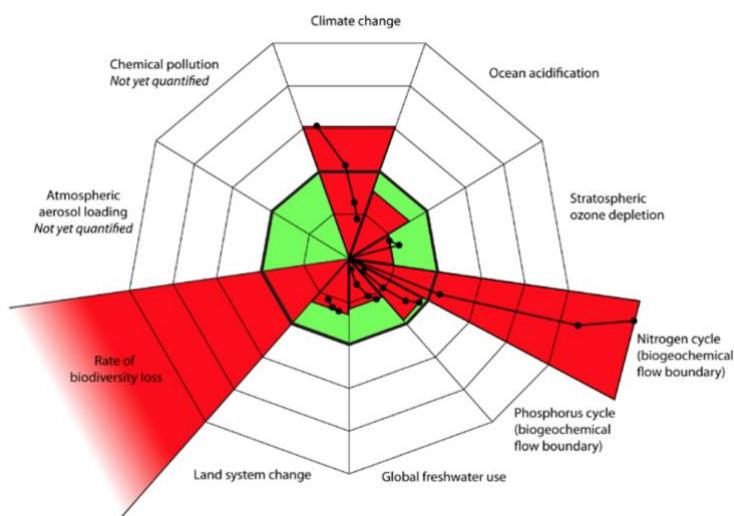


Figure 1. Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., de Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., ... Foley, J. (2009). Planetary Boundaries: Exploring the Safe Operating Space for Humanity. *Ecology and Society*, 14(2). <http://www.jstor.org/stable/26268316>

The Social Ecological Economic Development Studies (SEEDS) Program at the UBC was launched in 2000, and has been devoted to assisting the establishment of the Climate Action Plan (Gillies et al., 2021). In coordination with Campus and Community Planning's sustainability and engineering department, SEEDs assists the creation of practical biodiversity communication solutions on UBC Vancouver campus to raise biodiversity awareness in the local community. Thus this project is developed under SEEDs supervision targeting identification of biodiversity communication challenges with a foundational definition for “Biodiversity” and development of potential strategies to improve students’ engagement in biodiversity conservation. Since it might cause confusion to the general public about biodiversity if a brand new definition is created, to reduce communication challenge, the arguments and prospective recommendations in this project will be delivered based on the IPBES’s definition of biodiversity present in the Appendix.

3. Study Area: UBC Vancouver Campus

The major reason I choose UBC Vancouver as our study area is its suitability for communicating biodiversity messages due to its urban setting, rich biodiversity, and community with diverse educational backgrounds.

There have been growing threats to urban biodiversity conservation because of the sprawling urban landscape, which infers that not only does the non-human world affect ecological values, but also contribute to immediate social challenges (Shwartz et al., 2012). However, current biodiversity communication to the general public, particularly in an urban setting, is very limited. Under the social context where the existing educational communication is severely lacking in biodiversity, increase of such education is imperative to address biodiversity challenges in urban communities. UBC Vancouver Campus, being a world-class educational institution in environmental sciences that is located in a city, but surrounded by nature, is hence an ideal choice for further investigation.

Additionally, despite the fact that significant resources have been devoted to climate change and biodiversity communication, the reason behind the lack of understanding and the inadequate awareness over the issue might be that the target audience of public campaigns are those who are already conscious of biodiversity loss (Fukano et al., 2021). UBC, in fact, faces the same challenges. Although UBC offers a wide range of environmental courses to students, communities within campus, particularly those who are not in science major, are not familiar with the impacts of biodiversity loss. To develop biodiversity communication strategies targeting the general public rather than those who are relatively knowledgeable on the topic, I believe UBC is a good choice for this chosen topic of exploring methods to increase biodiversity awareness.

4. Methodology

In this paper, a literature review and qualitative analysis will explore the existing biodiversity communication approaches at UBC and potential practices that could be adopted in the future. To evaluate UBC's current approach, I will consider UBC's published reports, including the "UBC Vancouver Campus Climate Action Plan 2030", annual reports from different departments, and other UBC official websites that are affiliated with UBC Campus + Community Planning.

Potential suggestions for future biodiversity conservation practices will be developed primarily from the "Behaviour Change for Nature: A Behavioural Science Toolkit for Practitioners" and a review of biodiversity communication practices by other non-Government organisations (NGOs), specifically concerning the present biodiversity communication framework. At the end of the paper, a list of recommendations regarding biodiversity conservation will be included.

5. Different Actors of Biodiversity Communication at UBC

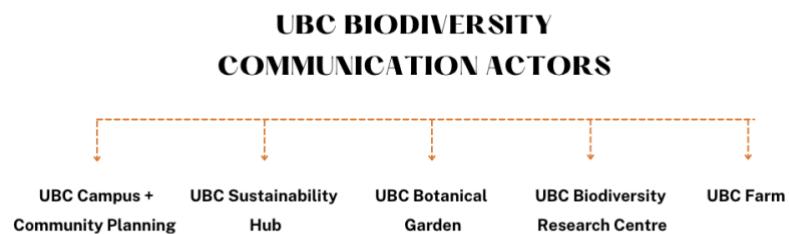


Figure 2. Actors of Biodiversity Communication in UBC: UBC Campus+Community Planning, UBC Sustainability Hub, UBC Botanical Garden, UBC Biodiversity Research Centre, and UBC Farm

The five main actors of Biodiversity Communication in UBC are the UBC Campus + Community Planning, UBC Sustainability Hub, UBC Botanical Garden, UBC Biodiversity Research Centre, and UBC Farm.

5.1. UBC Campus + Community Planning

UBC Campus + Community Planning (C+CP) creates plans to build a sustainable community at UBC (Who We Are | UBC Campus & Community Planning, n.d.). UBC SEEDS lives within UBC Campus + Community Planning, as part of the Sustainability and Engineering team, which also leads a number of Sustainability Action Plans (e.g. Climate Action Plan) and sustainability engagement programs.

UBC's first Climate Action Plan Report (2010) does not discuss biodiversity as a goal. Subsequently, the Climate Action Plan 2030 (2021) and the five year strategic plan 2022-2027 (2022) incorporate biodiversity into campus planning. These plans show that biodiversity conservation is beginning to show up in the university planning agenda.

Apart from UBC's broad overall plan, the Campus Biodiversity Initiative: Research and Demonstration (CBIRD) under SEEDS, creates interdisciplinary partnership between different stakeholders on campus to improve biodiversity partnership, practices, and create societal influence. SEEDS has also conducted biodiversity activities (SEEDS Sustainability Program, n.d.). UBC Climate Emergency funding has issued \$50,000 to UBC SEEDS to support co-curricular and curricular opportunities for 35 students on topics such as ecological connectivities (Annual Sustainability Report, 2021).

5.2 UBC Sustainability Hub

To mitigate climate-change driven impacts, the UBC Sustainability Initiative (USI) (n.d) was established in 1998 on campus to incorporate sustainability into its academic and operational approach. In 2022, the USI was renamed the UBC Sustainability Hub to increase emphasis on engagement (Who We Are, n.d.). This unit is affiliated with climate, sustainability, environment, and biodiversity related institutes on campus.

Regarding the funding contributed to the increase in Climate (and biodiversity) Education under the UBC Sustainability Scholar Program, the new Climate Education Grants Awards which value \$50,000 were granted to create relevant university courses which influenced 3300 students (Climate Education Grants, n.d.). Meanwhile, the Climate Emergency Fund totalling \$140,000 was provided as student internship funding on applied research projects that include biodiversity topics (Annual Sustainability Report, 2021).

Among the range of milestones UBC proposed, UBC's "20-year Sustainability Strategy" plan was the core sustainability strategic plan, developed in 2014. However, community engagement from the plan is mostly concerned with sustainability, but not anything explicitly regarding biodiversity conservation.

5.3. UBC Botanical Garden

The UBC Botanical Garden hosts a range of activities to let the UBC community know more about biodiversity (Vision & Mission, n.d.). Education, research, community outreach, and public display are done with the garden living collection of temperate plants. For instance, UBC Botanical Garden hosts The Friends of the Garden volunteer group and interns to volunteer or work in the garden when appropriate (Friends of the Garden, n.d.).

Aside from the various academic services and opportunities provided by for student research and projects, a wide range of activities and resources are promoted by the garden to encourage biodiversity awareness, such as the horticulture training program, Vancouver Tree

App, tours and field trips, “Artist in Residence” program, and various other interactive programs for the public to participate (Learn, n.d.)

To complement the UN International Day for Biological Diversity, in 2021, UBC Botanical Garden, in collaboration with UBC SEEDS, implemented Biodiversity Days. This included two weeks of public events that attracted 4,000+ participants into activities that are mostly climate-change and biodiversity related (Annual Sustainability Report, 2021). This activity reflects the increasing effort made to promote biodiversity to the public not only through conducting research, but with a community engagement perspective.

5.4. UBC Biodiversity Research Centre

In terms of UBC's academic approach to biodiversity conservation, UBC Biodiversity Research Centre (BRC) was launched in 2005 with \$8 million in donations from alumni (UBC Receives \$8 Million to Launch Biodiversity Research Centre, 2005). In addition, UBC's biodiversity approaches at the BRC are mostly affiliated with school courses and are conducted with funding training, scholarships, and postdoctoral opportunities (Biodiversity Research Centre | Beaty Biodiversity Museum, n.d.). Comparably, although there is ongoing biodiversity research taking place in the Beaty Biodiversity Museum (BBM) in collaboration with the BRC, the BBM is more community-oriented where community-engagement activities include, but are not limited to, in-person and online tours, programs, exhibitions, and biodiversity explorers activities (Learn | Beaty Biodiversity Museum, n.d.). Other activities in the museum mainly target biodiversity engagement to increase biodiversity awareness among children (Learn | Beaty Biodiversity Museum, n.d.). For instance, age specific programs are organised for children from grades K-12 or above with options according to visitors' interest (Learn | Beaty Biodiversity Museum, n.d.)

In 2021, a \$40 million request proposal to expand the BBM and BRC for the purpose of increasing existing research and museum activities was submitted to the Property Committee at UBC (Beaty Biodiversity Centre Addition, UBC Vancouver, 2021). This indicates a goal for increase in the range of biodiversity focused activities in BBM either in size or with the potential of implementing new activities. On the other hand, from UBC BBM's annual report starting from annual year 2013-2014, to 2020-2021, education and outreach expenses have always been \$10,000 per year, suggesting that spending on increasing biodiversity education is not shown to be a priority even though the scale of other dimensions in the centre is expanding (Annual Report, 2013-2021.).

5.5. UBC Farm

The major purpose of the UBC Farm is acting as a research, learning and teaching place of the Centre for Sustainable Food System to explore the connections and potential to incorporate agriculture and biodiversity in organic farming. (About Us | CSFS at UBC Farm, n.d.). Although UBC Farm hosts various biodiversity related programs, most of the programs were not implemented to support biodiversity communication.

The biodiversity monitoring plan is UBC Farm's first attempt to increase stakeholder awareness about the importance of biodiversity conservation (UBC Farm Long-Term Biodiversity Monitoring Plan, 2019). More specifically, through communication, reporting, education opportunities, internship opportunities, community outreach, social media, and data

sharing. UBC Farm also plans to deliver the results of the biodiversity monitoring program to the UBC community through public communication (UBC Farm Long-Term Biodiversity Monitoring Plan, 2019).

The cost breakdown of the whole monitoring plan could be \$15588 CAD or \$11278 CAD depending on equipment set up costs and the amount of equipment purchased (UBC Farm Long-Term Biodiversity Monitoring Plan, 2019). The ongoing cost would be approximately \$900 CAD per year (UBC Farm Long-Term Biodiversity Monitoring Plan, 2019).

6. Biodiversity communication strategy from international organisations

It is a social norm that conservation is about changing human behaviour (Green & Williamson, 2019). In fact, the significance of behaviour change as tools to achieve the 2 °C goal from the Paris Agreement, has been increasingly acknowledged by international bodies, such that the role of behaviour change is now included as one of the models of achieving climate goals by the Intergovernmental Panel on Climate Change (Newell et al., 2022).

Nevertheless, studies and implementation of strategies to create behaviour change has not yet been fully incorporated into conservation design(The nature of change, 2017). Fortunately, there is an increasing effort of production of frameworks and biodiversity toolkits created by world-leading NGOs for the purpose of raising communities' biodiversity awareness.

As mentioned earlier, shaping behaviour and engaging those who are less aware are the major goals of this research. In order to recommend something specific for the UBC community, the section would include a brief explanation of behaviour change and biodiversity focused toolkits proposed by the Centre for Behaviour and the Environment with support of strategies from the World Wild Fund (WWF), and Climate Outreach's toolkit.

The toolkit published by the Centre for Behaviour and the Environment is an inclusive toolkit which provides suitable approaches and strategies for users to develop their own set of communication techniques, mainly on the perspective of changing behaviour through assessing audiences' conscious and non-conscious behaviour (Green & Williamson, 2019). This toolkit would be appropriate for consideration at UBC as it could then seek the possibility to switch audiences' behaviour in a holistic approach. The recommendation section would primarily be based on this kit.

WWF's toolkit is about guiding youth to do hands-on biodiversity conservation work by themselves and provide materials for them to conduct self-directed biodiversity conservation work. This practice would be more approachable by UBC once the local community becomes more aware of biodiversity conservation. As a result, this toolkit might be potentially implemented by UBC as one of the activities of biodiversity conservation targeting students who have relevant background knowledge.

Finally, the toolkit from Climate Outreach is included in the section mainly to provide some additional information other than what's already mentioned from the previous behaviour toolkit. The kit was designed to increase climate change awareness. Due to the similar nature of climate change and biodiversity, this kit is included to provide context of the current approach to shape behaviour for climate change mitigation. Compared to Rare's behaviour toolkit, this kit provides more detail in terms of tips for individuals to deliver messages in a

systematic way to attract readers. There are a series of actions that users could consider for effective communication from Principle one of building trust, to Principle six of using effective visual presentation. Details of the toolkits are as follows.

6.1. Rare's Centre for Behaviour and the Environment

Behaviour Change for Nature: A Behavioural Science Toolkit for Practitioners

“Behaviour Change for Nature: A Behavioural Science Toolkit for Practitioners” depicts 15 strategies that have been proven successful to facilitate behaviour change specific to biodiversity conservation (Green & Williamson, 2019). First, the tool defines target behaviours to alter for the purpose of conservation with a comprehensive visual presentation of target audiences, conservation threats, and target behaviours (Green & Williamson, 2019).

Green and Williamson (2019) next suggest consideration of three insights on conventional wisdom including: the need to focus on non-conscious decision-making processes, setting of behaviour, and the importance of focusing behaviour instead of awareness, attitudes, and intentions (Green & Williamson, 2019). Fifteen suggested strategies are categorised into three categories: motivating, socialising, and easing the change (Green & Williamson, 2019).



Figure 4. 15 biodiversity communication strategies concluded from Behaviour Science

Retrieved from Green, K., & Williamson, K. (2019). *Behaviour Change For Nature: A Behavioural Science Toolkit for Practitioners*. Bi.team. <https://www.bi.team/publications/behavior-change-for-nature-a-behavioral-science-toolkit-for-practitioners/>

In terms of motivating changes, the first strategy is to make the target audience feel the pride and joy for working on the targeted behaviour (Green & Williamson, 2019). The second strategy is to make people feel connected to the issues, such as the goods brought into them through conservation (Green & Williamson, 2019). Personalising and humanising messages is the third strategy which describes how climate chaneg or biodiversity loss would affect your surroundings with identifiable characters (Green & Williamson, 2019). The fourth strategy is to let people know the long term impact the topic has to them if they do not change their behaviour (Green & Williamson, 2019). Finally, to motivate change, designing incentives with minimal cost to the planning agent, but valuable to actors, would be very effective (Green & Williamson, 2019).

Regarding the potential of socialising changes, the promotion of desirable norms would lead to the Bandwagon effect, thus people might feel the appropriateness to act in a certain manner (Green & Williamson, 2019). Harness reciprocity, in comparison, is to provide incentive through providing someone a gift, which would make the person feel the obligation to repay, thus changing behaviour (Green & Williamson, 2019). Similar to strategy 6, strategy 8 increases behavioural observability and accountability to make the public feel embarrassed for not performing socially acceptable behaviour (Green & Williamson, 2019). Strategy 9, which suggests the encouragement of public and peer-to-peer commitments, is to encourage the public to commit and make public pledges to an action, so they would have the tendency to keep their promise (Green & Williamson, 2019). Getting the right messenger is strategy ten. It is proposed that getting the right person who is either credible or of whom the general public admire, allows people to find their words convincing, thus changing behaviour (Green & Williamson, 2019).

The five strategies to ease change are generally about making the change in behaviour easier. First, removing frictions and promoting substitutes forbid the public to find “doing the right thing” too inconvenient (Green & Williamson, 2019). Furthermore, providing support with planning and implementation intentions, and altering choice setting, again supports the public to increase their intention and make unsustainable practice inconvenient through infrastructure betterment (Green & Williamson, 2019). Also, simplifying messages and decisions helps with guiding the public to know the most important component over the topic and not shift focus (Green & Williamson, 2019). Lastly, using timely moments, prompts, and reminders, provide consistent reminders to the public, so they might persist in their new habit and slowly make the new practice a regular routine (Green & Williamson, 2019).

In general, the toolkit provides an inclusive alteration in behaviour through altering individual’s personal preferences, building a sense of social responsibility, and infrastructural melioration for easier change in behaviour.

6.2. World Wild Fund (WWF)

A Toolkit for Local Action on Biodiversity For educators and youth leaders

Different from the behavioural science toolkit, this kit was created to guide youth to lead LAB projects that would create leaders to monitor and improve local biodiversity (WWF, 2020). The three steps are “Seek”, “Connect”, and “Act”(WWF, 2020). The project would start with encouraging youth to seek opportunities to conserve biodiversity in the selected region, namely the neighbourhood where youth live(WWF, 2020). The second step would be evaluating the hypothesis and other findings to other LAB projects via the Our Planet Live website (WWF, 2020). Finally, the last step is to make the change through creating a comprehensive plan, fundraising, and sharing the findings with the community (WWF, 2020).

6.3. Climate Outreach

Principles for effective communication and public engagement on climate change

The Principles for effective communication and public engagement on climate change was created by Climate Outreach with the purpose of raising awareness over climate change (Corner et al., 2018). Although the communication toolkit was not created for raising

biodiversity awareness, strategies suggested in the toolkit could be applicable for this purpose due to the similar nature of the two topics. Details of the steps are indicated in the table below.

Table 1. The Six Principles for effective communication and public engagement on climate change

1. Be a confident communicator	<ul style="list-style-type: none"> • Build trust through communicating factors of one's area of specialty
2. Talk about the real world, not abstract ideas	<ul style="list-style-type: none"> • Explain with laymen terms and clear language • Use metaphors and analogies
3. Connect with what matters to your audience	<ul style="list-style-type: none"> • Learn about people's values and political views in order to adapt to their interest when delivering messages
4. Tell a human story	<ul style="list-style-type: none"> • Deliver messages through telling stories with narrative structure
5. Lead with what you know	<ul style="list-style-type: none"> • Present data and messages that are acknowledged by professionals • Avoid talking about factors that remain to be unknown
6. Use the most effective visual communication	<ul style="list-style-type: none"> • Catch people's attention using visual images along with verbal and written communication

Reference: Corner, A., Shaw, C., & Clarke, J. (2018). *Principles for effective communication and public engagement on climate change A Handbook for IPCC authors outreach CLIMATE. In Climate Outreach*.

The six principles are “Be a confident communicator”, “Talk about the real world, not abstract ideas”, “Connect with what matters to your audience”, “Tell a human story”, “Lead with what you know”, and “Use the most effective visual communication”(Corner et al., 2018). While the behaviour toolkit has included some of the suggestions from this principals toolkit, this model could be incorporated with the behaviour toolkit to create a more inclusive biodiversity toolkit. This kit, compared to the behaviour toolkit, gives out more promotional ideas and how the visual presentation should be constructed.

7. Discussion

Toolkit applicability and usage

From the previous section, I found that although some of the departments within the school conduct outreach activities related to biodiversity conservation, the primary focus of current biodiversity engagement approaches at UBC are predominantly learning and research-based. Moreover, the existing biodiversity outreach programs at UBC BBM primarily focus on biodiversity education catered towards youth and children, but do not particularly target UBC students. Other programs either prioritise community engagement based on climate-change mitigation and adaptation, or devotion of resources on biodiversity research. In addition, the few departments in which outreach programs do currently exist have typically not seen an increase of funding throughout the years.

Overall, even though some departments at UBC have increased funding for biodiversity conservation, these programs are mostly research-based with a limited communication and outreach component. Due to the lack of direct community engagement events on campus, many people at UBC are not well-versed in the causes and ramifications of biodiversity loss. This situation, as compared to the extent to which sustainability practices are enacted on campus, provides that measures targeting biodiversity conservation are very limited. As such, when deciding what measures to be taken as suggested by the toolkit, it is important to implement strategies that are applicable to the current situation specific to the UBC campus.

Among all the three toolkits, the Rare and Climate outreach's toolkits are most similar in terms of their usage of shaping behaviour and providing suggestions to create effective communication strategies. With many overlapping ideas, the Rare kit has a wider coverage of ideas to shape behaviour. For example, both kits describe the significance of using visual presentation, the cruciality of seeking to change behaviour instead of raising awareness, and how to be specific and allow the audience to connect themselves with conservation. The difference between the two lies in which the Climate Outreach kit suggests the use of real life examples while the Rare kit suggests telling a story in a narrative manner. This practice could be used as UBC implements the 15 strategies from the toolkit.

The toolkit by WWF, however, is different from the other two in terms of the action it initiates; it aims to inspire people, youth in particular, to conduct independent research for themselves in order to appreciate first-hand the beauty and importance of nature. This kit is useful in the UBC context as it increases community awareness through encouraging the UBC community to conduct directed studies and personal projects on campus. Given that UBC has multiple zones designed for recreational and educational purposes, there are many options on where and how to conduct biodiversity conservation projects.

Since all of the kits are guides that have been proven practical to shape behaviour, this section suggests how the above-mentioned strategies could be applicable at UBC. I believe using flagship species as a marketing tool, hosting citizen science activities, and creating online programs are some applicable approaches for use within campus to motivate, socialise, and encourage change. While these measures are more applicable as a motivation tool, they could also be used for easing and socialising change; thus, the recommendation section includes some suggestions that are not fully extracted from supporting literature, but are relevant to the other recommendations.

Studies suggest that social marketing campaigns support environmental laws and regulations, thus changing human behaviour (Jenks et al., 2010). According to Jenks et al (2010), the branding strategy of the St. Lucia Parrot was claimed successful in contributing to policy change and the implementation of social pride. In this case, individual consumption and lifestyles could be changed to become more eco-friendly (Venghaus et al., 2022). Flagship species are often used to spark communities' interest (Melero, 2017). Indeed, selecting flagship species for the purpose of initiating education campaigns and community development projects are both suitable for achieving biodiversity targets (Melero, 2017).

Regarding the implementation of the citizen science(CS) program, research delineates that participation in hands-on work for these CS programs influences motivation (He et al., 2019). Moreover, it is noted that urban environmental education at school increases local biodiversity through enhancing children's awareness, attitude, and knowledge (White et al., 2018). Action-based learning and wildlife experience are particularly beneficial in creating a human connection to nature, thus increasing public interest and understanding regarding the suggested topic(White et al., 2018). Additionally, students' well being and situational emotion has proved to be more positive when educational activities involve live animals(Schönfelder & Bogner, 2018). As such, there is a positive relationship between the significance of intention of pro-environmental behaviour and situational emotions(Schönfelder & Bogner, 2018).

From a previous case study, it is revealed that immediate interest in local urban biodiversity and direct conservation benefits occurred alongside an increase in participation

level of citizen science volunteering (Shwartz et al., 2012). Additionally, sustained participation in gardening practices benefited butterflies leading to an increased population.(Shwartz et al., 2012). As such, UBC Farm and the Pacific Spirit Park could be some suitable locations to deliver citizen science programs. An inclusion of these programs to complement Biodiversity Day may increase student engagement in biodiversity programs.

Inspiring one's connection with nature is one of the most effective measures to engage people in biodiversity conservation (Novacek, 2008). Although hands-on experience often contributes to increase in overall activity experience, online programs could be more viable and cost effective. Nevertheless, both online and hands-on education modules have claimed to increase willingness to conserve pollinators like the honeybee with similar results (Schönfelder & Bogner, 2018). For these pollinator conservation modules, the perceived danger to the corresponding pollinator has been reduced up to six to nine weeks after initial participation of both of these education modules. It is proposed that a one day field trip providing direct encounters with snakes reduces fear of snakes while increasing the willingness to protect them (Schönfelder & Bogner, 2018). Since the decrease for protection of species does occur as program time goes by, biodiversity programs should be implemented on a regular basis.

Programs specifically concerning pollinators are proposed to be effective with the implementation of both online and in-person programs, but the eLearning option provides more flexibility(Schönfelder & Bogner, 2018). Having a lot of experts in biodiversity conservation on campus, video recordings or even live virtual events could be implemented at UBC as an alternative to in-person programs. With professional help, an increase in authority may increase credibility on the topic at hand.

Alternatively, developing strategies so that individuals feel obligated to act in a certain way as a tool to socialise change could be implemented at UBC among and within the faculty. A study in France reveals that farmers are more likely to continue sustainable farming practices if they are made aware that others are exercising the same practices (Green & Williamson, 2019). A similar approach could be used on campus; for example, if there is a competition among students in their conservation methods, they may put extra effort to behave as recommended in order to win said competition.

Another example of socialising change is to make connections between global public health and biodiversity loss to harness cognitive biases (Gregg et al., 2021). In times of pandemic, everyone is affected to a different extent. Using fear as a tool to highlight the quantity of viruses in nature allows the public to understand the interconnectivity and importance of altering their behaviour and conserving nature (Gregg et al., 2021). Under the social context of Covid-19 and the constantly changing pandemic restrictions, it is easy for everyone to connect with the idea of how we are being greatly affected. In this case, during the presentation of different programs at UBC, drawing the connection between pandemic and biodiversity loss would allow people better relate to the idea.

Additionally, using non-financial incentives at UBC to encourage students with souvenirs could make them feel the sense of belonging to the school and their need to align to the school's mission. A study in Zambia proposed that non-financial incentives that allow communities to feel their contribution to the social good is more effective than providing financial incentive (Green & Williamson, 2019).

Finally, creating an infrastructural change would help make changing behaviour easier. These actions do not require the communities' engagement, so it is applicable to the school as long as there is sufficient funding and support from on-campus vendors.. For instance, Bacon et al. (2018) pointed out that consumers tend to consume plant-based meals more when those meals are placed within the same page of the menu with meat, instead of being on a separate page. Other measures such as simplifying messages, providing reminders, and changing choice settings could all be easily applied by the school without the need to rely on community's engagement.

8. Recommendations

This section would include the list of recommendations regarding how UBC could apply the 15 strategies suggested by the Behavioural Toolkit into practice to increase biodiversity awareness through a changing environment. More specifically, only with more investment in biodiversity communication, changes could be made to increase community's awareness, thus improving campus's biodiversity richness.

Overall, regarding biodiversity communication with different groups, I believe the definition of biodiversity could be slightly altered as different groups may be intrigued by different things. For example, when communicating biodiversity with children, biodiversity might be described as the marine, terrestrial, and freshwater species, while the definition could increase in complexity when communicating with adults and the elderly. More details of the definition can be found in the appendix.

8.1. Motivate the Change

8.1.1. Marketing flagship species in the local region

- UBC could integrate marketing practice on flagship, indicative, or keystone species in order to build local pride over selective species to increase biodiversity awareness. Potential solutions include using posters, stickers, and billboards to deliver messages (Jenks et al. 2010).

8.1.2. Carry out regular in person citizen science activities

- Increase nature events to engage and spark students' interest to act upon biodiversity conservation. For instance, there could be more promotion of volunteer programs as well as more components of biodiversity education could be added to the volunteer programs at UBC farm and BBM.
- Activities such as the youth engagement using the WWF toolkit could be an alternative as a self-guided biodiversity protection activity

8.1.3. Frame messaging to personal values, identities, or interests

- Implement some online materials and establish a series of programs targeting pollinator conservation for students to take at UBC Farm and UBC Botanical Garden, both areas suitable to deliver biodiversity messages.

8.1.4. Personalise and humanise messages and harness cognitive biases

- A possible biodiversity promotion method is to underscore how the ongoing pandemic, Covid-19, is related to biodiversity loss and human activity. Providing sufficient information of its causes and ramification on online forums, program implementation, and online lectures.
- Providing a list of actions including reduction of farmed meat consumption and wildlife trade, so the public would consciously acknowledge the effectiveness to act upon the issue.

8.1.5. Design behaviorally-informed incentives

Urban Biodiversity Day

- Implement programs on Biodiversity day that connect with the student society on campus.
- Communicate with all registered student societies in UBC and ask the president from the clubs to encourage members' participation on UBC Biodiversity Day.
- Design competition and games which require collective effort from each group.

8.2. Socialise the Change

8.2.1. Promote the desirable norm

- Provide data on the average recycling and consumption behaviour on disposable items from each Faculty and compare the numbers.
- Post the results indicating preferable behaviour arranged by group on the communication board in each Faculty to promote a competitive atmosphere.

8.2.3. Increase behavioural observability and accountability

- Establish competition via biodiversity programs participation or biodiversity photography competition among faculty or among people from different majors in environmental science.
- Target audience: Faculty that are science related with less focus on biodiversity conservation

8.2.4. Encourage public and peer-to-peer commitments

- During school orientation, hand out questionnaires to ask if students are willing to join biodiversity conservation programs and receive emails related to campus beauty and biodiversity events. Invite students to attend those programs after class the following day. Try to host more sessions for online or in-person programs relating to campus biodiversity.
- Always include the time slot for the next program before people leave from each activity.

8.2.5. Communicate with authority

- Invite an outreach team from well-known international or local organisations to present on biodiversity conservation practices in the area on UBC orientation day.

- Invite professors specialised in biodiversity conservation to present on Biodiversity Day or during biodiversity programs where the number of target participants is above 200 people.

8.3. Ease the Change

8.3.1. Make it easy by removing frictions and promoting substitutes

- Selling coffee mugs close to restaurants and drink shops
- On orientation day, write the number of the disposable paper and plastic cups an average student uses within the university beside the booth.
- Provide the number of disposable items already used on campus

8.3.2. Provide support with planning and implementation of intentions and alter choice setting

Facilitating Recycling Behaviour

- Stick an eye-catching logo on one of the sinks in each restroom on campus signifying its purpose to let people clean recyclable products in this sink.

Changing Food Choice

- Provide vegan options and a menu of vegetarian food that could be used to cook with food sold from UBC Harvest.
- On sign up forms for food, include a question about whether or not customers prefer vegan or meat options. When presenting the vegan option, show the meals that are available to customers.
- Do not provide straw and paper bags to customers unless otherwise requested
- Increase the price of paper bags or disposable containers.
- Place the healthy food items at the top or the bottom of a menu as consumer are twice as likely to order them
- Instead of including plant-based dishes in a separate section, integrate them into the menu (Green & Williamson, 2019).

8.3.3. Simplify messages and decisions

- Provide concise and succinct instructions with clear direction making it easier for the audience to know what they need to do.
- Write slogans and quotes such as “Less meat”, “Consume Less”, “No straw” around campus to give the audience a clear picture of what they can do to protect biodiversity.

8.3.4. Use timely moments, prompts, and reminders

- Require logos regarding biodiversity loss or for pro-conservation behaviour(not buying illegal wildlife products, etc) in stores to remind consumers to use reusable products upon their next purchase
- Mark visible and clear signs on fencing on bike or running trails to remind users of sensitive habitat

1. Appendix A: Biodiversity Communication Resource

9.1. Biodiversity and related concept

Biodiversity is a vague concept with highly capricious measurements (Sarkar, 2002). There has been much controversy around how to define the term. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (n.d) provided an inclusive definition of biodiversity as “the variability among living organisms from all sources including **terrestrial, marine and other aquatic ecosystems** and the **ecological complexes** of which they are a part. This includes variation in genetic, phenotypic, phylogenetic, and functional attributes, as well as changes in abundance and distribution over time and space within and among species, biological communities and ecosystems’.

To make the definition simple, I break down the definition to the highlighted part of the above definition, which indicates that living organisms on land, in the sea, and upon the freshwater habitat, are all part of the biodiversity. Approximately 1.5 million known species on earth are macroscopic organisms living under a diverse range of ecological habitat within these three main streams of ecosystems (Grosberg et al., 2012). The distinct habitat each type of species is adapted to is formed by the topographic complexity (Strain et al., 2021). Ecological complexes, which is similar to the concept of habitat complexity, generally have a positive relationship with the distribution of biodiversity, so it is a major contributor of biodiversity (Velasco-Charpentier et al., 2021).

Ecosystem services is the concept of human beings benefitting from the natural ecosystem to sustain their lives (Evers et al., 2018). There are four categories of ecosystem services, including provisioning services, regulating services, cultural services, and supporting services. Provisioning services are the material goods extracted from the ecosystem (National Research Council, 2013). Regulating services are functions in nature that regulate the ecosystem process, thus getting the system back to equilibrium (Millennium Ecosystem Assessment., 2003). Cultural services are the non-material advantages provided to human beings from ecosystems, such as spiritual recreational values (Millennium Ecosystem Assessment., 2003). Supporting services are the indirect benefits people receive from nature, such as nutrient cycling and soil formation (Millennium Ecosystem Assessment., 2003). These four services have provided almost everything essential to human life.

According to the Climate Action Plan 2030 (2021), resilience is defined as “an ongoing process of diverse, interconnected relationships and processes that activate and build up resilience-enhancing capacities within and across a community for short, medium and long term sustainability and wellbeing”. Resilience is an important concept when it comes to biodiversity conservation and long term sustainability goals because maintaining a rich biodiversity is critical for a sustainable ecosystem function (Oliver et al., 2015).

Human intervention to nature has contributed to ecosystem vulnerability and loss of environmental resilience. Given the importance of ecosystem services to human beings, there are even more reasons for us to conserve biodiversity as it is a critical part of providing ecosystem services. To sum things up, raising awareness and shaping behavioural change in biodiversity protection is not just important, but necessary, for the ecosystem to sustainably provide its service for human use.

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