Research Article

Grove Virtues: Vulnerable Mangrove Channel Spots Detector for Mangrove Forest Management

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Abstract: *Humans have started to explore mangrove channels but it has costed the environment to be at vulnerable state, due to the pressure from human activities and natural stressors, such as climate change. Retreating mangrove can negatively impacting mangrove area and indirectly jeopardize mangrove community income and job stability. Therefore, it is essential to identify vulnerable spots in the mangrove channel to preserve the mangrove area while maximizing the economy of the mangrove community. However, this assessment can be difficult as it requires a comprehensive analysis of multiple parameters over a vast area. This complexity can make vulnerability assessment difficult for the mangrove forest management to protect these vital marine ecosystems, and indirectly making the efforts to apply sustainable management seems impossible. To address this challenge, Grove Virtues, is proposed for a simplified assessment method to evaluate the vulnerability of mangrove channels for improving mangrove forest management. Grove Virtue aims to rationalize the assessment along the mangrove river area by detecting vulnerable spots and appropriate locations for program planning applicable to the management, making vulnerability assessment more straightforward and well-organized to categorize the status of mangrove areas and determine their vulnerability. Grove Virtues is featuring remote sensing and visual observation techniques to evaluate six key parameters: mangrove coverage, mangrove species, sea level, channel width, boat frequency and bioturbation. Grove Virtue development will be in the digital-based products and the vulnerability categorization will be based on the vulnerability index developed. The Grove Virtues offers the advantages of being less time-consuming, low manpower and requiring fewer resources over traditional assessment, making it more accessible to mangrove forest management. Additionally, vulnerable spots from Grove Virtues help to prioritize conservation and economic activity systematically and sustainably.*

Keywords: Mangrove Assessment, Vulnerability, Sustainable Management.

1. INTRODUCTION

Mangrove forest is widely spread through the globe intertidal area and mangrove channel can formed within the forest with dense dendritic or meandering pattern, which this marine ecosystem has various vital environmental services such as being barrier to the high energy waves and home to thousands of marine flora and fauna (Carugati et al., 2018). Not only that, mangrove forest also beneficial to human in economy and social sector where coastal and mangrove community can exist

within the mangrove area, generating income and creating job opportunities through various scope, and this trend has been seen growing throughout the globe especially in South East Asia, where mangrove forest has been converted into shrimp farm and the channels filled with tourism activity (Goldberg et al., 2020; Treephan, Visuthismajarn & Isaramalai, 2019). This create a harmful pressure towards mangrove cover including the mangrove channel where the human activity has been seen to be negatively impacting the area (Rasyid et al., 2016). This situation encourages mangrove forest management to carry out the vulnerability assessment in the area to assess the vulnerable area that not only exposed to human activity, but also natural stressors such as sea level rise for the management efforts. However, this vulnerable assessment can be quite challenging to be achieved as the mangrove area and its channel is not only vast, but this assessment also traditionally required complicated parameters. This creates a concerning gap between mangrove forest management and sustainable human activity in the mangrove and its channel area.

To tackle this complex issue, a simplified and straightforward mangrove channel vulnerability assessment, Grove Virtues, is developed. Thus, this Grove virtue have objectives of not only provide comprehensive mangrove channel vulnerability assessment but also to provide straightforward mangrove channel vulnerability assessment for mangrove forest management. By integrating Grove Virtues into the mangrove forest management, it will perchance, initiate a long protection effort for our mangrove ecosystem (SDG14), increasing the awareness in combatting climate change effects for a better environment (SDG13), and eventually help the local communities to strive towards sustainable cities (SDG11).

2. METHOD & MATERIAL

Grove Virtues is developed based on combination of high functionality of satellite data and observational data which focusses on six parameters, mangrove coverage, mangrove species, sea level, channel width, boat frequency and bioturbation. Where, mangrove forest management as user can access Grove Virtue through smartphones and computer as it is a digital-based product, choosing the year and location of interest, and keying in the observational data (eg: bioturbation and mangrove species) into the system. The six aforementioned data will be calculated into a developed mangrove channel vulnerability index, where it is divided into five categories, ranging from very low vulnerability to very high vulnerability that highlight the vulnerable hotspots. This categorization will help the mangrove forest management to focus on highly vulnerable area rather than spending their time and money to understand the vast mangrove forest and it is channel.

3. FINDINGS

The Grove Virtues have offers advantages of less time-consuming, low man-power and requires fewer resources over traditional assessment, making it more accessible to mangrove forest management. Additionally, vulnerable hotspots form Grove Virtue help to prioritize and organize conservation and economy activity systematically and sustainably.

Figure 1: Grove Virtues home page.
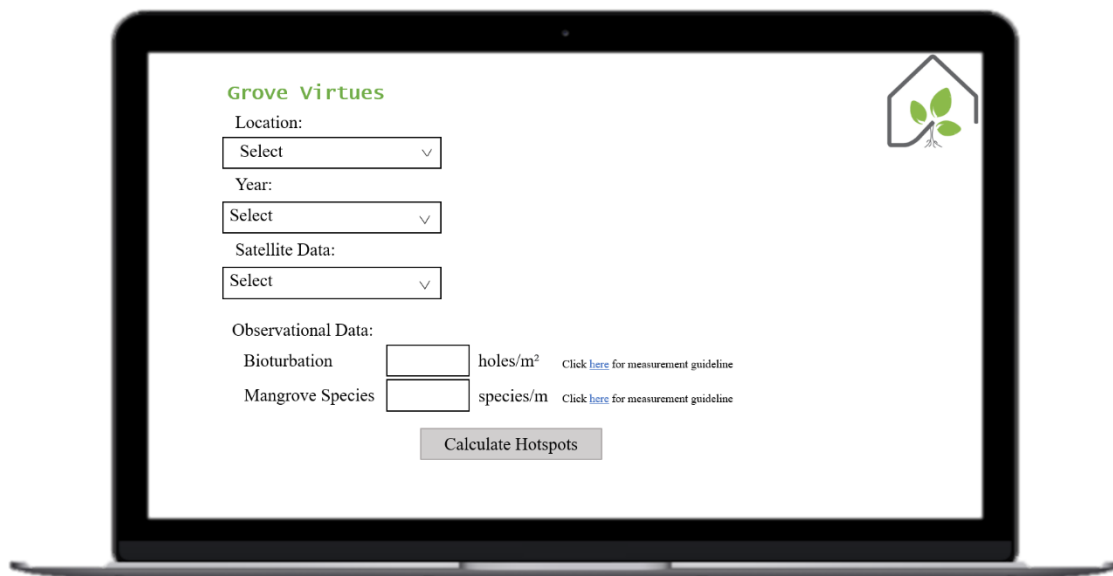
Figure 2: Grove Virtues user page with parameters involving for the mangrove channel vulnerability assessment.
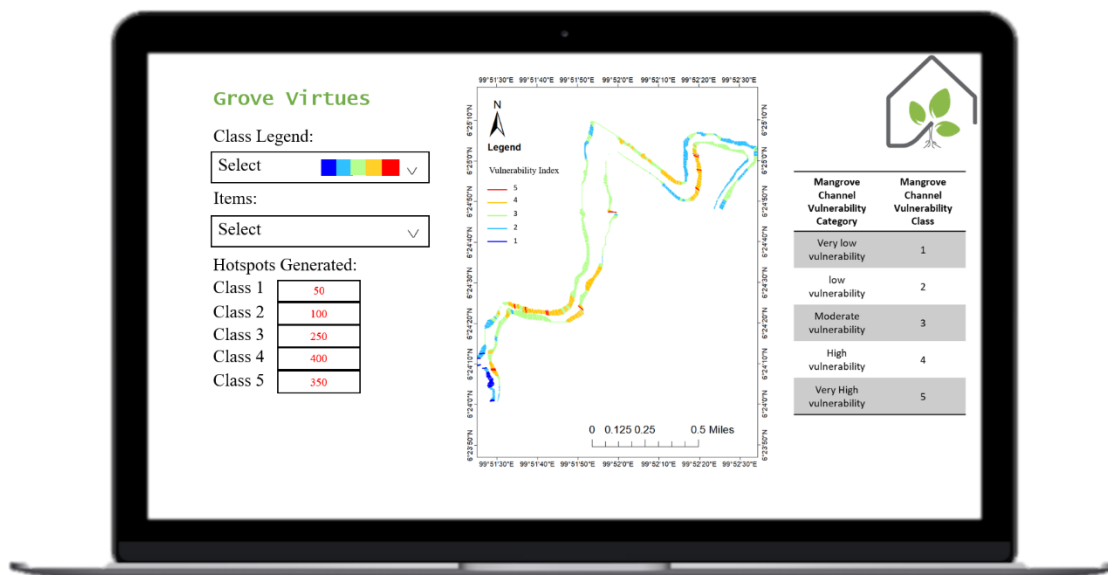
Figure 3: Grove Virtues output map where it displays the vulnerable hotspots along the mangrove channel into five categories

4. DISCUSSION

Grove virtue is the first simple assessment to evaluate mangrove channel vulnerability for sustainable mangrove forest management that community can participate. With the benefits of Grove Virtues, it is having an expected impacts to make science simpler in the eyes of mangrove forest management and more straightforward to be understood. Thus, it has served social responsibility of initializing the prioritization of conservation and management efforts, provides straightforward categorization mangrove areas condition, suggesting hotspots for appropriate program planning applicable to the community and involving community to citizen-science concept. Grove Virtues have commercialization potential to mangrove forest management as it acts as sustainable mangrove forest management.

5. CONCLUSION

Assessing vulnerability in mangrove area with dense channels will be challenging and with Grove Virtues, it is expected to make the vulnerability assessment easier as it is not only time saving, but also cost effective. Grove Virtues also will be expected to initiate conservation management in the mangrove area in the long run to maintain the importance that mangrove forest offers, to nature and humans.

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