



Ben Stern (January 13, 2020)

*ENS 233
Advanced Aquatic Ecology*



Oyster Culture Site Suitability Analysis

Using Geographic Information Systems to Identify Suitable Oyster Culture Areas in Hinigaran River

Special Problem

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Contents



1. Introduction

2. Related Literature

3. Methodology

4. Discussion



[Viviana Rishe \(August 9, 2018\)](#)

Introduction

Importance, benefits and rationale behind creating a site suitability analysis for oyster culture in Hinigaran River



Rationale

Oyster culture in the Philippines began at Hinigaran, Negros Occidental, in 1921 (BFAR CARAGA, 2017).

I was lucky enough to have visited Hinigaran and witnessed the beauty of oyster culture in the area. They were served fresh in local restaurants and was a huge part of the town's culture.

However, oyster culture in Hinigaran River (and in the country) has a lot of problems and has now caused a decline. This decline in oyster culture was attributed to the rising production costs and slack demand due mainly to the poor sanitary quality of the product.

Aside from the former issue, the river is now also overcrowded with a lot of oyster culture structures which makes it difficult for the local fishermen's boats to pass.



Objectives

The main objective of the study is :

- To produce suitable sites for oyster culture in Hinigaran River with respect to both the promising oyster culture traditions and as well as the utilization of the rivers passageway for fishermen.





Objectives

In order to accomplish the main objective, we need to be able to accomplish these two sub-objectives:

- To be able to identify the identify and collate suitability indicators for oyster culture.
- To be able to use Geographic Information Systems in doing a suitability analysis for oyster culture.





Significance

This study will be beneficial to the following sectors amongst many:

- Oyster Culture Community
 - By finding suitable sites for oyster culture, it will be beneficial to oyster culture farmers by aiding them with which areas are better.
- Fisherfolk
 - By including distance from the banks as a suitability criteria, it would give more freedom for fisherfolk to pass through the river.
- Tourism
 - If oysters are a hit abroad then it is definitely going to be a delicacy that Hinigaran could be proud of. This can hopefully boost tourism in the area and give opportunities to everyone in the town.
- Local Government Unit
 - By improving the situation of the oyster culture, this will boost their revenues and in return provide better services for their people.



Scope and Limitation

Due to the ongoing pandemic, there is currently almost no primary data that was collected by me and other data that will be cited in the this presentation are mostly found online.

Furthermore, the different parameters and indicators that were cited in this presentation was based from the presenter's understanding and no peer or group of experts have analyzed the set of parameters. However, shall there be any changes in the parameters to be used, the GIS implementation can definitely cater to changes in the number of factors involved as long as the factor can be represented in a raster or a shapefile.

Lastly, the presenter is basing the main methodology from an already presented relevant topic on a conference but on this particular proposal, a new set of indicators that are vital for the site suitability will be included as well.



[Edsece Stansberry \(October 25, 2018\)](#)

Related Literature

What do we know about oysters and oyster culture?

Oyster (Talaba)



C. Iredalei (Zainathan, 2017)

Various species of oysters are found in almost the entire coastal areas of the country and they are particularly abundant in bays and estuaries that have some runoff from the land. Four species of oysters are cultured in the Philippines, the slipper-shaped oyster *Crassostrea iredalei*, the subtrigonal oyster *C. malabonensis* and the curly or palm rooted oysters *C. palmipes* and *Saccostrea cucullata*. The species receiving particular attention in terms of culture are *C. iredalei*, which are usually 6–9 cm long when marketed and the moderately sized *C. malabonensis*, which are usually 4–5 cm long.



Oyster

Oyster or *talaba* is a popular bivalve delicacy because of its excellent flavor and taste. It is mostly marketed in the shell as freshly-shucked meat. Some salted oyster or bagoong are made during peak harvest season. It is rich in vitamins, minerals, proteins and carbohydrates. The shells are mostly used as raw materials for the manufacture of lime and poultry grit. The shells also serve as spat collectors for culturing.

[Bruce Chapman \(February 21, 2020\)](#)

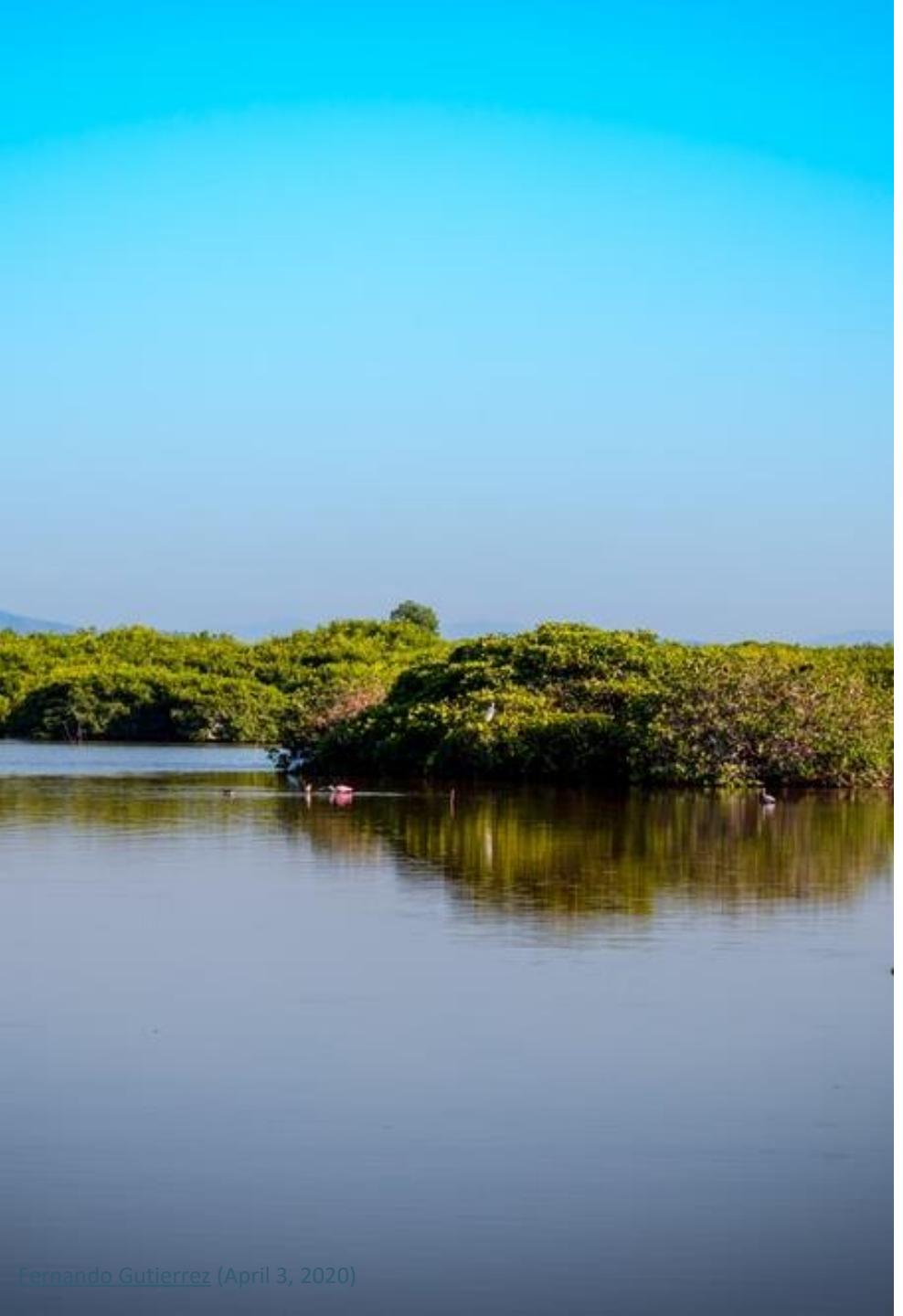
Oyster Culture

Oyster culture in the Philippines began at Hinigaran, Negros Occidental, in 1921 (BFAR CARAGA, 2017).

Hinigaran is a 1st class municipality in the province of Negros Occidental, Negros Island Region, Philippines. (Hinigaran.gov, n.d.)

From 1983 to 1986 there was an annual growth rate of about 36 %. The total area of oyster farms in operation in 1986 was 467 hectares in contrast to the 707 hectares the previous year (Malig and Edra, 1987). Such decline was attributed to the rising production costs and slack demand due mainly to the poor sanitary quality of the product.





Site Selection



Oysters thrive best in brackish to marine waters with salinity ranging from 15-26 ppt at 20-30°C water temperature. Viable oyster farming grounds have indigenous species of spawners that are present. The water should be free from pollution with green to blue-green color. The area should be free from flooding that may result to 0-10 ppt salinity; this causes heavy mortality and heavy siltation. Water depth should be at least 1.5-4.0 m at the lowest tide. The bottom is either hard non-shifting or soft and muddy. Areas for culture must be naturally protected against strong wind and wave action along landlocked bays or estuaries.

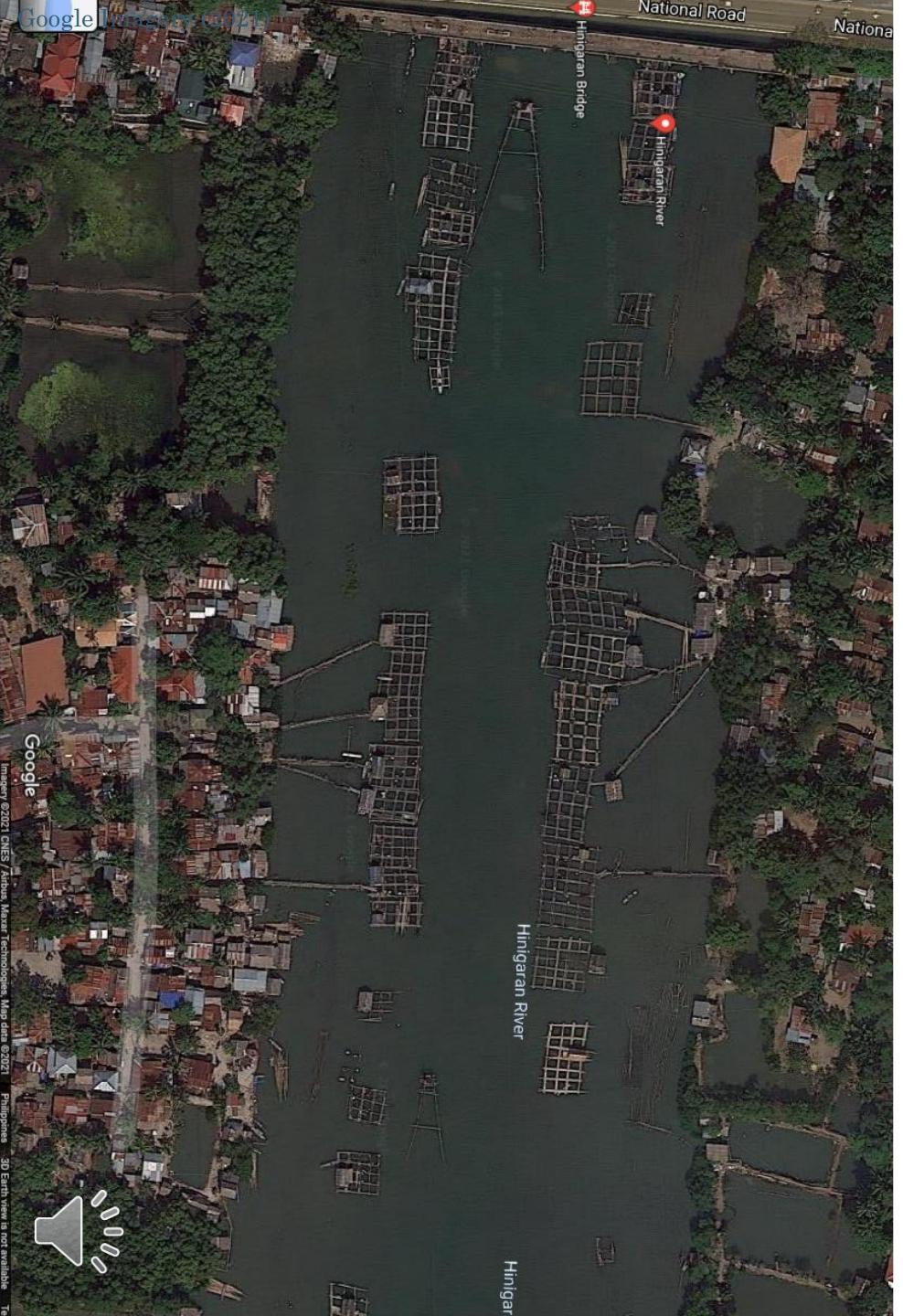


Sanitary Quality

Poor sanitary quality and limited demand are probably the major reasons for the failure of oyster farming to expand rapidly. Due to the former constraint the Philippine oyster export market is practically non-existent.

Furthermore, around 150,000 households in Negros Occidental have no toilets , making it the province with the most serious “open defecation” problem areas (Nicavera, 2016). It is important to note that there is no data yet as to where these households exactly are but the 28.88% without toilets sounds like an alarming number for the province.





Overcrowded

When I visited the river, we were actually having a hard time navigating through the river since there were a lot of structures blocking the way, some structures are active and some are abandoned.

The river is being used by fishermen from further along the river to reach the sea, this can cause issues specially when it gets harder to navigate these rivers because there is no management or limit being followed as to how and where these structures for oyster culture can be built.



Proper Site Selection

The choice of site is absolutely critical as this determines to a large extent the impact of the farm. The nature and magnitude of effects largely depend on site-specific conditions relating to the intensity of farming, flushing characteristics of the environment, and the proximity of the farm to valued habitats (e.g. rocky reefs) and species (e.g. nesting shorebirds) (Ahmed & Solomon, 2016)). It would be interesting to create a site suitability analysis for oyster culture along the river. This could be done with the aid of geographic information systems.





Eradicate Open Defecation

Defecating in the only option for some, but for others it is the preferred method. Using a local river or stream, or even the bush, may feel better than using a hole in the ground that smells or has flies and lacks light (Ahmad, 2014). Local district and village capacity is of utmost importance. This means that local leaders and frontline workers to have the capacity, technical knowledge and incentives to engage communities with behavior change interventions and facilitate interaction with private sector providers (Ahmad, 2014). We must empower the local government unit and allot a budget for the eradication of open defecation.





River Management

Old and unused structures for aquaculture within the river shall be removed. There should be a tally through geotagged location and accounting of each and every oyster farm within the river. This can be done by visiting all the owners and geotagging their oyster farm for easier tracking.

The local government unit shall also provide a rule or a policy as to the maximum allowable distance from the banks that the oyster farm can be placed so that there will be no overcrowding of physical structures. Hopefully, this measure can aid in the overstocking of oysters since the owners will now be regulated.

Furthermore, areas with allowable oyster culture structures could be subdivided into blocks and distributed to the oyster farmers so that there is order and easier tracking of oyster production.





Research Gaps



Hinigaran is not a very popular place in the country and oyster is not a very popular food in the country too which makes it harder to find localized literature about the current situation.

There is currently no published journal addressing the site suitability analysis for oyster culture along Hinigaran River. However, there is a conference proceeding for the same. Unfortunately the paper lacked a few more factors that are vital for the site suitability for oyster culture. From here, we aim to add a few more factors.

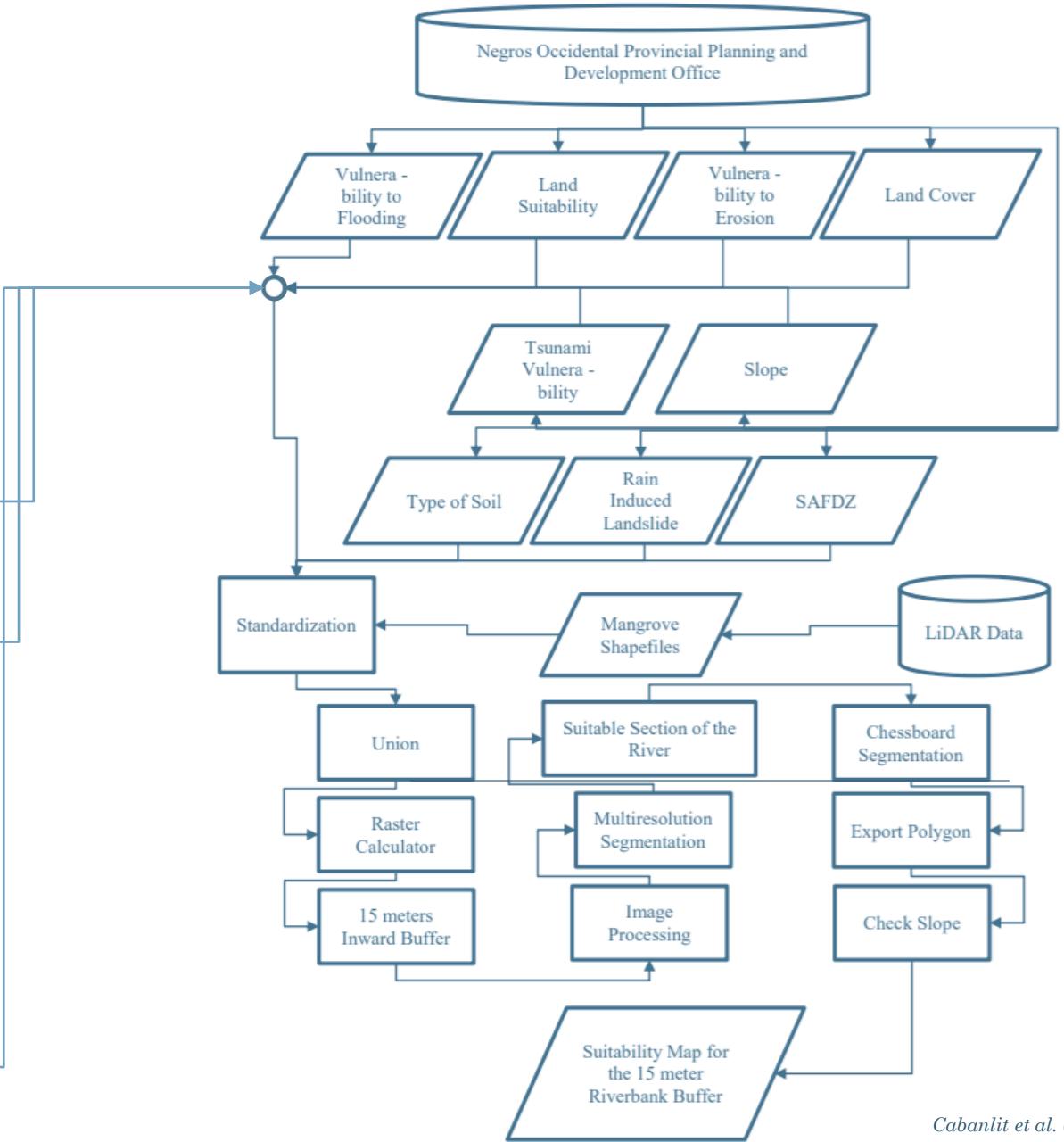
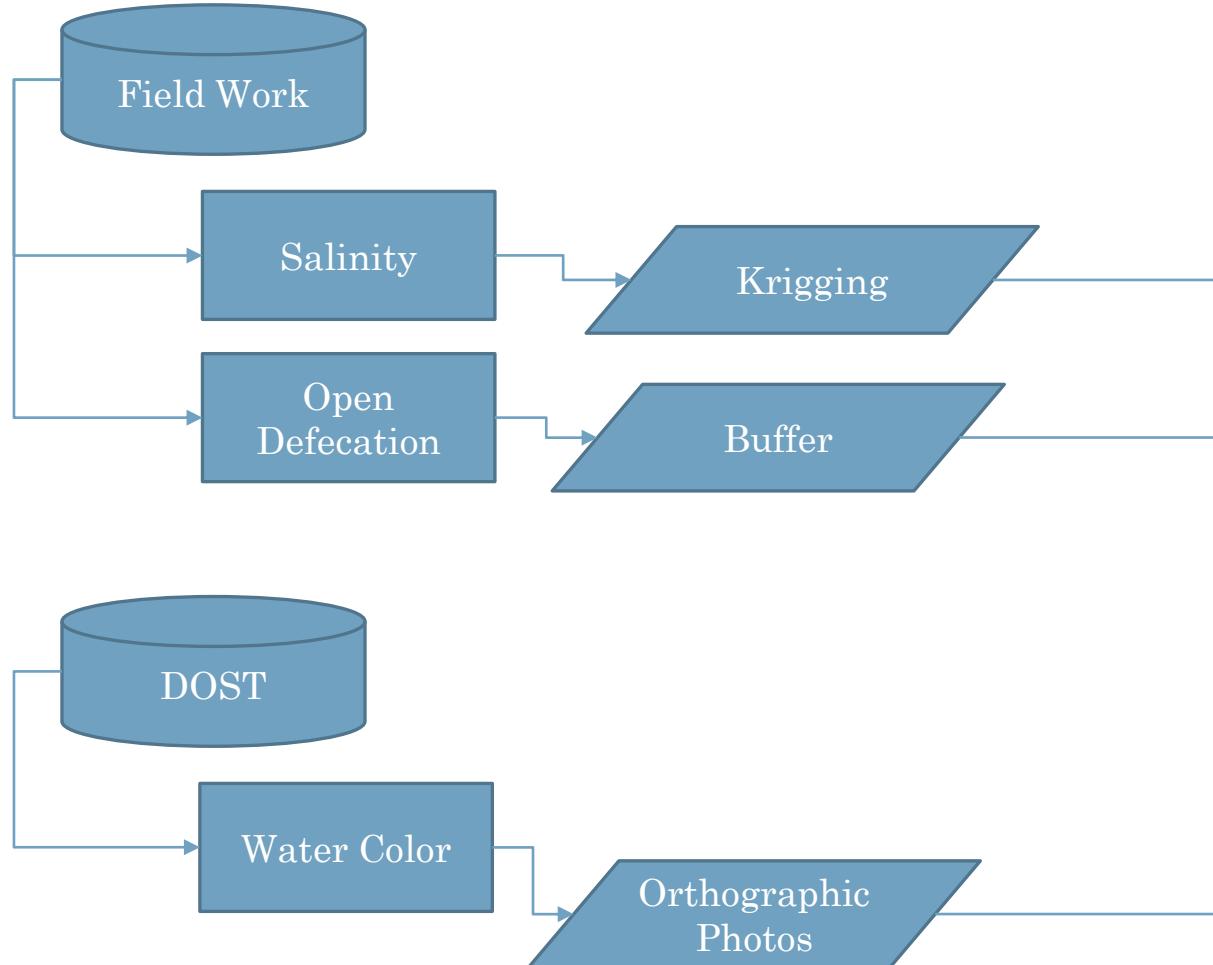


[Bruce Chapman](#) (February 21, 2020)

Methodology

The proposed methodology for the Site Suitability Analysis

Workflow



Cabanlit et al. (2016)

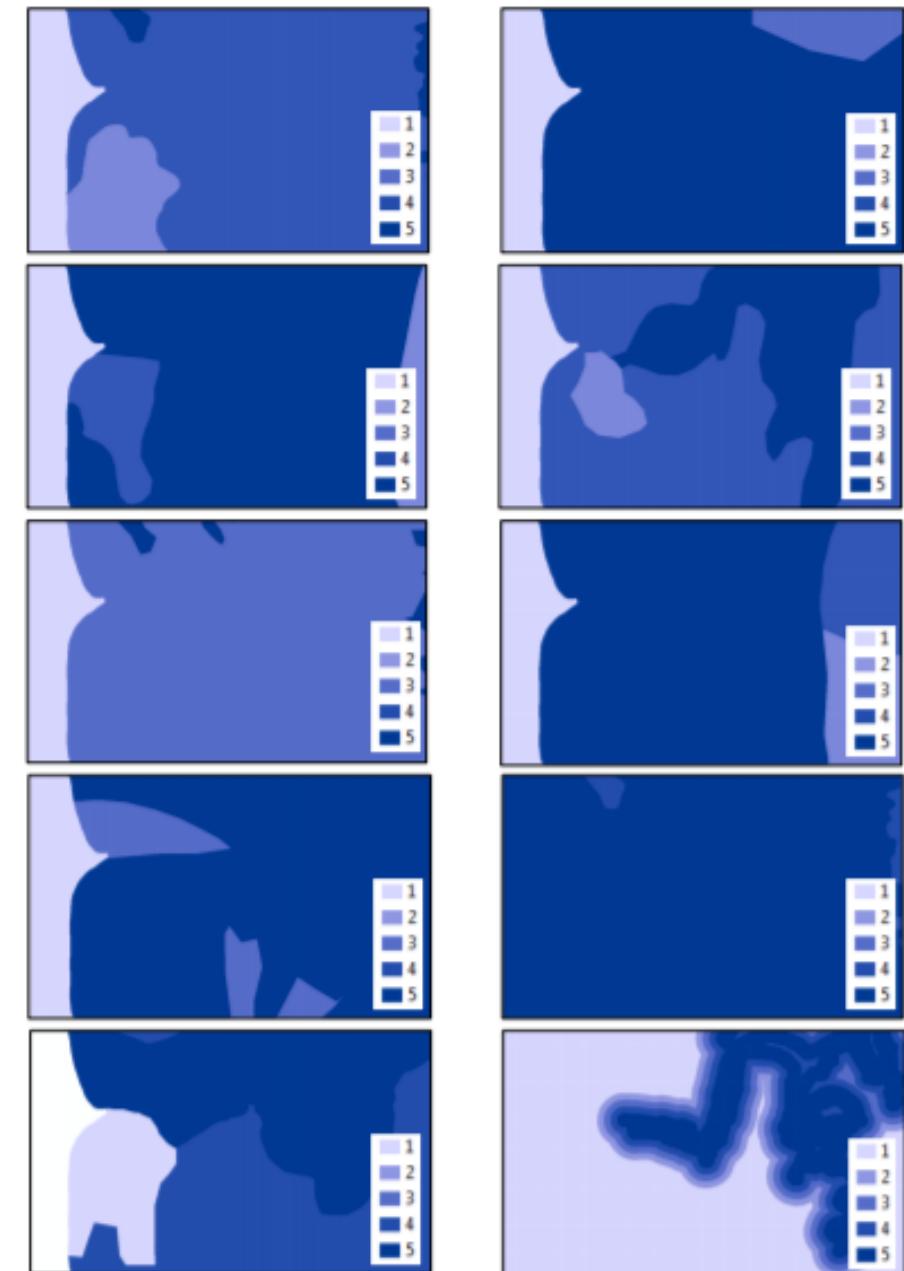


Image Processing

Perform standardization of weights per suitability criterion. After analyzing all the shapefiles, a union was performed. Given the union of all the layers, the suitability factor was calculated and was used to determine which sections of the Hinigaran River have the most suitable location for river-based aquaculture. Through image processing the LiDAR data was segmented according to the resulting union of the suitability layers, the river shapefile and the 15 meter buffer along the sides of the river.

After segmentation the thematic layer from the suitability layer was used to classify suitable areas of the river. These area was then divided using chessboard segmentation. Each of the objects generated from the chessboard segmentation was then exported together with mean LiDAR values for analysis in ArcMap. The output shapefile was then loaded in ArcMap and was then classified based on slope.

Cabanlit et al. (2016)



Figures 3 - 12. From left to right, then from top to bottom: Layer Weights for (3) Vulnerability to Flooding, (4) Land Suitability, (5) Vulnerability to Erosion, (6) Land Cover, (7) Tsunami Vulnerability, (8) Slope Classification, (9) Type of Soil, (10) Rain Induced Landslide, (11) SAFDZ, (12) Mangroves.



Union

The resulting attribute yielded values ranging from 5 to 1. Values greater than 4.5 was considered acceptable.





All suitable buffers were then segmented using Chessboard segmentation with 10 as the object size. The candidate class was then exported together with their slope values.

Segmentation of Suitable Area





[Viviana Rishe](#) (August 9, 2018)

Discussion

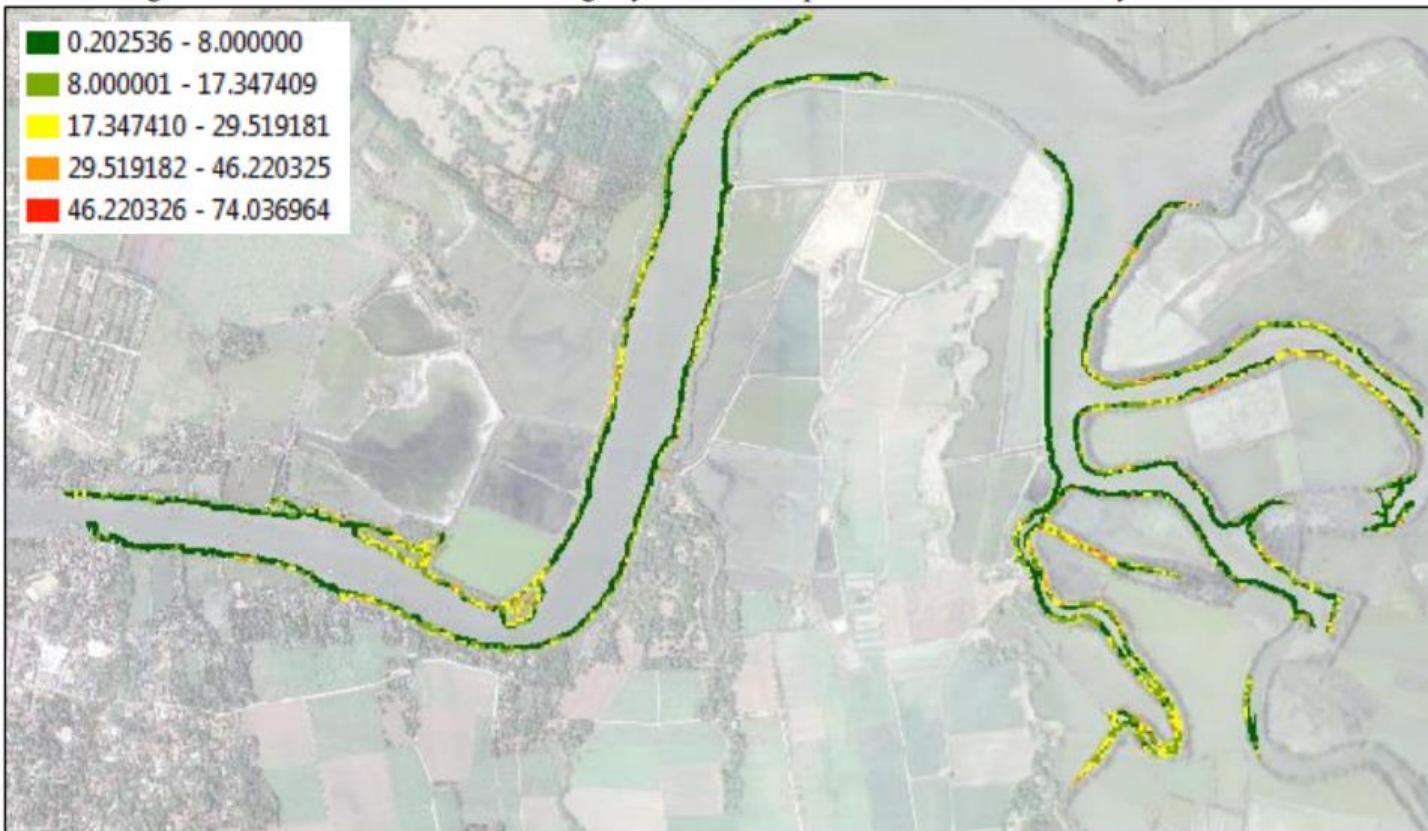
What is the expected output of this special problem?

Expected Output



Depending on the slope threshold that will be agreed upon from a panel, we will analyze the suitable which in this sample map will be the green colored areas.

This is just a sample output map as we have included a few more critical factors for the analysis.





Management



The results will then be relayed to the local government unit in order for them to see the differences or possible mitigation measures such as those features outside the deemed suitable zone.



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Thank you! 