**Practical with MarxanWeb: Guiding Questions**

Before you begin to work through these Guiding Questions, ensure that you have read through the Marxan Guide document – use the two documents together! Read through each section carefully to make sure you understand what we will do and how things work before answering the questions. The guide is for you to work through the scenarios in a structured way and to ensure you understand what you are doing.

**Conservation Problem Formulation**

The purpose of this section is for you to think about the conservation problem at hand. Before you use the software, think about what your decision making is all about. What are the biodiversity patterns? How do the data we have represent these biodiversity patterns?

**1. What is the point of assessing different scenarios in a spatial planning analysis with Marxan?** (think of three main points)

**Allows for consideration of different outcomes depending on political landscape.**

**Accounts for shared space, limited resource of space.**

**Explore different objectives for different stakeholders**

**Allows for analysis of unintuitive concepts like clumping or 1000 species.**

**2. Is there a reef species richness gradient (i.e., species turnover) in Micronesia?** (think of two main points)

**Reef related habitats.**

**West to east**

**3. The habitats data are describing the same morphological features across Micronesia (though there is a difference between high islands like Pohnpei and RMI).** **Which aspects of reef community biodiversity would they best describe/ be a surrogate for?**

The species diversity gradient across the region.

The similarity of the morphological features is proof that there is no diversity gradient across the region.

The morphological classes are not a good representation of reef biodiversity because species always move across these morphological types.

Species and functional groups that associate with each habitat, such as the different communities supported by different depths.

**4. The bioregions dataset delineates bioregions that are specific to each part of the region. They can best represent:**

Species turnover or biodiversity gradients across the region.

Endemic species that only occur in certain atolls/ islands.

Rare species that are seldom observed/ present.

Species that are important for the recreational fishery.

I am unsure.

**5. The best surrogate for representing reef biodiversity would be to use both the bioregions and morphological habitat classes datasets.**

YES

NO

**6. Explain your reasoning for your previous answer.**  (think of 4 main points)

**If considering coral assemblages then yes but may not be as representative for fish assemblages as the threshold of dependence on landscape is different.**

**Gap Analysis**

(work out where the current existing MPAs are, and where there are still gaps. The goal here is to look at the map and think about it, not run an analysis)

**7. Where are current MPAs in Micronesia? (IUCN I+II MPAs)**

Central Palau

Helen Island

Northern Marshall Islands

Chuuk State

Kosrae

Southern RMI

Southern Central FSM

**8. Explain whether it is likely that all species are already protected/ or not, and why.** (think of 2 main points)

**Unlikely due to endemic species not covered by protected areas.**

**Dispersal patterns through lfie cycle affected by lack of connectivity of protected areas.**

**Scenario 1: All available information**

**9. Insert your selection frequency maps of scenario 1 below for the 5% and the 30% targets.**

The purpose of this effort is to illustrate the influence of changing conservation feature targets on PA system configuration.

Insert Figure(s):

**10. Insert your plots showing how changing targets affect Conservation Benefit, Cost, and Number of Planning Units.**

Insert Figure(s):

**11. Briefly explain how changing targets affect Conservation Benefit, Cost, and Number of Planning Units.** (think of three main points)

**Scenario 2: Cost**

Use the 30% target for all conservation features from the previous analysis. We need to now work out how to best represent the cost. On one hand, it would be good to know how solutions pan out when only biological criteria are used to inform the conservation priorities. On the other, displaced fishing pressure presents an actual cost to fisheries and governance. To evaluate whether/ how conservation priorities and the conservation benefit achieved differ between these two cases, run these scenarios:   
- Equal area as cost (each planning unit has a cost of 1)  
- Fishing pressure as cost (each planning unit has a cost that reflects fishing pressure, some lower, some higher than 1)

**12. When using equal area as cost, the solution table gives identical values for Score, Cost, and Planning Units selected. Is this correct and why/why not? Highlight your answer.**

No not correct, these values should always be different.

Yes, it is correct, because we are setting the cost to 1 for each planning unit and the score of the objective function is the sum of cost.

Yes, it is correct, because with equal area as cost the objective function in Marxan excludes cost from the objective function.

**13. When using fishing pressure as cost, this strategy results in an increase in the number of planning units selected, and also a substantial increase in overall cost, compared to using equal values as a cost. How can this observation be explained?**

The extra planning units that are being selected are very costly.

Fishing costs per planning unit are generally higher than 1.

Fishers usually oppose protected areas anyway and so its best to ignore their opinions

**14. What other information might be used for calculating cost?**

Distance to markets for fisheries goods

Distance to population centres

Displaced extractive industries (e.g. mining)

Displaced maritime transport

All of the above

**Scenario 3: Reef morphological classes**

**15. Looking at the Selection Frequency Map, how are the areas of high selection frequency distributed in Scenario3? (excluding existing MPAs, which are always selected)**

All planning units are selected with the same frequency.

High selection frequency occur in Chuuk and Pohnepei (high islands).

Each country looks to have some high selection frequency areas.

Most of Palau is almost never selected.

**16. Do all the MC\_Habitats meet or exceed the 30% target?**

YES

NO

**Scenario 4: Reef bioregions**

**17. How did the Conservation Benefit change?**

It is higher in the bioregions scenario (Sc 4) than the morphological classes scenario (Sc 3).

It is higher in the morphological classes scenario (Sc 3) than the bioregions scenario (Sc 4).

**18. Looking at the Selection Frequency Map, how are the areas of high selection frequency distributed? (excluding existing MPAs, which are always selected)**

All planning units are selected with the same frequency.

High selection frequency occurs in Chuuk and Pohnpei (high islands).

Each country looks to have some high selection frequency areas.

Most of Palau is almost never selected.

**19. Look at and compare (insert if you want) your maps for Selection Frequency and the Best Solution for Scenarios 3 and 4.**

**20. How did the conservation priorities change between scenario 3 and 4?**

(think of 2 main points)

**Scenario 5: Adjacency of protected areas**

In spatial planning, we sometimes want to ensure that protected areas are not scattered across a land/ seascape, as there are benefits to large protected areas. In Marxan we use the Boundary Length Modifier (BLM) to increase the adjacency or spatial connectedness of a protected area system. Here, you will work with Bioregions and Morphological Classes, but no species and mangroves.

**21. What is a suitable approximate BLM value to achieve clearly visible clumping of selected planning units?** (a number) (here we are looking for an approximate range of possible numbers, i.e., whether it is 0.1 or 10000. There is no exact right answer)

**22. How does the spatial location of selected sites change with higher BLM, compared to BLM = 0?**

There is no change, the selected planning units are in the same places.

The selected planning units are clumping next to existing MPAs.

The selected planning units are clumping in the middle of the planning domain.

The selected planning units are clumping in the southern part of the planning domain.

The selected planning units are scattered more than with BLM = 0.

**23. Adjacency is a special case of connectivity more broadly. In Micronesia, would you recommend large clumped MPAs, small distributed MPAs, or something in between? Why? 🡪 we will look at this in the afternoon!**

**Scenario 6: Surrogate species/ features**

Surrogate species or features should represent all of reef biodiversity (or a specific taxon, group, etc.). Here you assess how suitable the proposed surrogate species are.

**24. Which species is the most suitable surrogate species for overall reef species across Micronesia?**

*Epinephelus ongus*

*Plectropomus laevis*

Mangroves

**25. Why is this species/feature most suitable?** (think of 2 main points)

**26. What makes a good surrogate species? Select all that apply.**

Use large areas of heterogeneous habitat

Use large areas of homogeneous habitat

Invulnerable to exploitation

Low socio-economic significance

Some influence on ecosystem functioning

All of the above

**27. Please contrast the Conservation Benefit for a) combined bioregions and habitat features, with that for only including b) *Plectropomus laevis*, c) Mangroves, and d) *Epinephelus ongus*.** Enter the values.

|  |  |
| --- | --- |
| Scenario | Conservation Benefit |
| a) bioregions and habitat features |  |
| b) *Plectropomus laevis* |  |
| c) Mangroves |  |
| d) *Epinephelus ongus* |  |

**Discussion and Implications**

**28. Of your analyses, which Scenario had the highest Conservation Benefit? Insert a figure displaying your comparison across all scenarios (Sc 1, all target steps; Sc 2; Sc3, Sc4, Sc 5, Sc 6, each species/habitat)!**

Insert Figure:

**29. Why do you think this pattern in Conservation Benefit is achieved? Lets discuss.**