

TECHNOLOGY CONSULTING

IN THE GLOBAL COMMUNITY

Final Consulting Report Palau Conservation Society

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January 2023

Carnegie Mellon University



Palau Conservation Society Executive Summary

Student Consultant, Rafay Khan
Community Partner, Lolita Gibbons-Decherong

I. About the Organization

The Palau Conservation Society (PCS) is a non-profit, non governmental organization which leads conservation efforts that take place in Palau. Founded in 1994, PCS is focused on conserving Palau's natural heritage for the citizenry with board members from the community.

The mission statement of the organization is as follows,

“Palau Conservation Society partners with communities to preserve the nation's unique environment, sustainable use of natural resources, and perpetuate our conservation ethic for the economic and social resilience of Palau.”

The Palau Conservation Society addresses issues ranging from local concerns such as establishing and managing protected areas to national level changes ensuring environmentally friendly policies are in place. Based on the organization's core values of respecting science, promoting sustainability, respecting Palau's culture and integrity, PCS has established four programs. These include the Conservation and Protected Areas Program (CPA), Policy and Planning Program, Communication and Outreach Program and Administration and Development Program respectively for each core value. With the growing demand for conservation efforts in the community, the organization continues to be more active across the multiple programs.

II. Improve public access to protected areas information

The CPA department has collected protected areas data in the form of a scorecard (excel sheets) that is used to organize the list and background information of the protected areas in Palau. The community partner wants to make this information available to the public (primarily Palauan students) who come to PCS to access this information which is normally given to them via paper documents, pamphlets or brochures. In addition, such information is not accessible online, not presented in a standardized manner and not updated regularly by the government or the protected areas network (PAN) office.

This entire process was digitized by making protected areas information public so users can obtain all the information from the PCS website. Protected areas information was made available online on the PCS website in a simplified manner after understanding how students and teachers interacted with protected areas data (based on several indicators which were finalized after consultations with Heather Ketebengang) such that PCS can update this

information (the PCS website is developed in WordPress and managed by M&D Web Creations) in the long run ensuring that the solution developed is accessible and sustainable in the long run. After extensive reviews of existing sample templates and several consultations with the global community partner and PCS employees, Figure E and F were seen as most suitable examples of what the sample solution should look like. Further feedback was taken after interviewing Palauan students and teachers, the primary users of the solution, and the final design was changed based on their feedback. The final design included information about the states and their respective protected areas which was taken from 40+ physical documents.

PCS was presented with the following recommendations:

1. In order for the protected areas pages to be maintained it is important that regular updates be made to the pages to ensure information is recent. Moreover, as more pictures are captured of certain remote protected areas and additional mapping is done it would be integral to have this updated on the PCS website.
2. Work with the Palau Automated Land and Resource Information Systems (PALARIS) and harness the existing collaboration between PCS and PALARIS to work on obtaining GIS based visuals, choropleth and other interactive maps of protected areas as well as high resolution images for the new protected area pages.
3. Creation of a database with protected areas data within the PCS website would not only help PCS store great amounts of data but it would update all this information in real time.

Consulting Partner

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Rafay Khan is a senior in Information Systems with a minor in Public Policy and Politics at Carnegie Mellon University. He is passionate about consulting, digital transformation and international development.

Palau Conservation Society Final Consulting Report

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I. About the Organization

Organization

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The mission statement of the organization is as follows,

“Palau Conservation Society partners with communities to preserve the nation's unique environment, sustainable use of natural resources, and perpetuate our conservation ethic for the economic and social resilience of Palau..”

The Palau Conservation Society first started the species based educational programs and over the years, the organization has expanded its efforts to address issues from local concerns such as establishing and managing protected areas to national level changes ensuring environmentally friendly policies are in place. Currently, the organization consists of 8 full-time employees and external support from general memberships and corporate partners. Based on the organization's core values of respecting science, promoting sustainability, respecting Palau's culture and integrity, PCS has established four programs. These include the Conservation and Protected Areas Program, Policy and Planning Program, Communication and Outreach Program and Administration and Development Program respectively for each core value. With the growing demand for conservation efforts in the community, the organization continues to be more active across the multiple programs.

Facilities

The organization consists of one office space located in Bai Ra Maibrel Koror, Palau. The office building is next to a fine dining restaurant named Elilai Seaside Dining and is located on the second floor. Each employee has access to either a desktop computer or a laptop with a designated workspace. Furthermore, the office is equipped with necessary office equipment for the organization's daily operations. There are no significant problems concerning the location, infrastructure, furniture, climate controls, or lighting issues that hinder their daily tasks; however, power outages in Palau tend to hinder daily tasks. While no individual has a designated position in maintenance, the staff have been able to resolve minor maintenance issues in the past.

Programs

The Palau Conservation Society has four main programs, Conservation and Protected Areas Program, Policy and Planning Program, Communication and Outreach Program and Administration and Development Program. An organizational chart (Figure A) shows PCS’ organizational structure and programs. These programs address PCS’ priority threats and targets with each program addressing a different geographic scope and core value of the organization (Figure B).

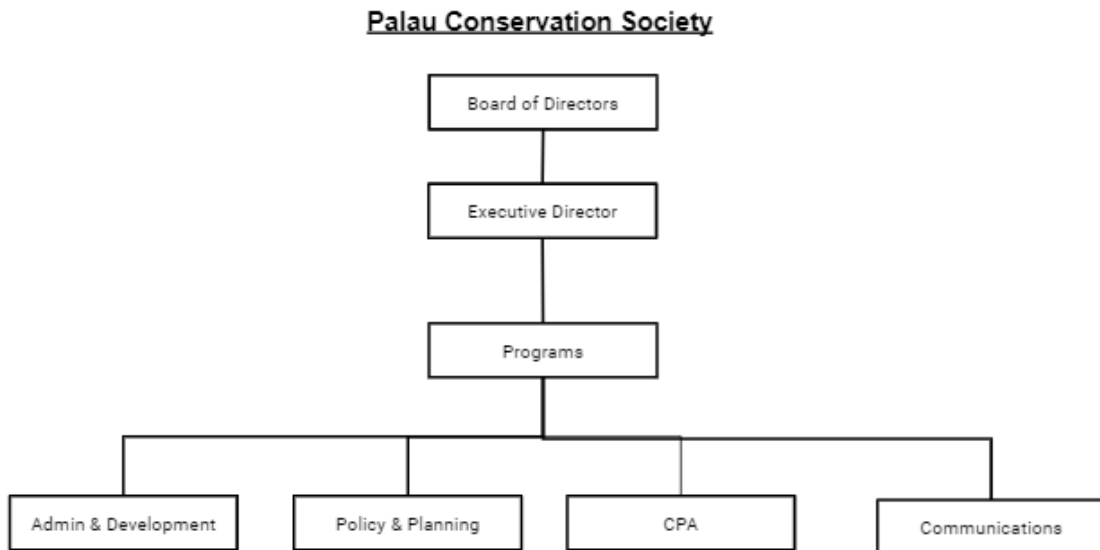


Figure A

Geographic Scope	Program	Targeted Core Value
Site and Community levels	Conservation and Protected Areas Program	Respect for Science
State, Watershed, and National levels	Policy and Planning Program	Belief in Sustainability
National, Regional, and International levels	Communication and Outreach Program	Respect for Palauan Culture
Organizational level	Administration and Development Program	Integrity

Figure B

Source: Palau Conservation Society

The Conservation and Protected Areas (CPA) Program is PCS’ oldest program which focuses on encouraging community engagement to protect Palau’s protected areas and various sites and species. The CPA program supports Palau’s 16 states with management plans and through the provision of financial resources via the Protected Areas Network (PAN) fund. In addition, the program assists partners to develop sustainable fisheries policies and practices, supporting private lands conservation initiatives and expanding partnerships for species protection.

The Policy and Planning and Practices Program (PPP) focuses on facilitating decision making and planning amongst PCS' partners. At the core of it, the PPP program works with state and national governments to advocate for policies that allow for Palau's sustainable development. Furthermore, the program facilitates dialogues and flow of information to ensure PCS has accurate information surrounding national policies. This flow of information allows for an enabling environment for accessing climate finance and enabling stronger climate action. Moreover, the program also involves building PCS' internal capacity to better advocate nature based solutions and communicate environmental and economic values.

The Communications and Outreach Program (C&O) focuses on species-based awareness campaigns, communicating key environmental messages, assisting partners in improving environmental education and utilizing diverse methods to communicate with diverse populations. As part of the 2022-2027 strategic plan, the C&O program will conduct outreach with external partners and stay at the forefront of communications efforts using technologies and online platforms. Examples of initiatives have included working with educational institutes to integrate environmental subjects into the curriculum.

The Administration and Development Program supports PCS' other programs by ensuring the organization has external support to meet respective objectives. The program focuses on the human resources, governance, administration of the organization, maintaining financial partnerships with donors raising funds and building support for PCS through communications and branding.

Past programs have included public awareness initiatives, community based marine and terrestrial research, identification of important bird areas, resource management and several community visit programs.

As assessed in a CMU's consultant final report with PCS last year, one of the areas of concern still remains the lack of integration between the four programs with no access to a central database to monitor work or store information. The absence of a central database makes it difficult to access any information needed from other programs/departments. In addition, PCS' website is outsourced to M&D web creations in Guam, which offers web design services to small and medium startup businesses. Heather Ketebengang from the Communications department liaisons with M&D Web Creations. Reliance on an outside organization also means delays in putting information onto the website and lack of agency over the functioning of the website. The lack of a technical lead within the organization has also led to the current problem of transparency of protected areas information on the website.

Staff

Currently, there are a total of 8 staff members in the Palau Conservation Society. This includes the interim executive director of the organization, three staff members in the Administration and

Development Program, one member in the Conservation and Protected Areas Program (CPA), two staff members in the Policy and Planning Program (PPP) and one member in the Communications and Outreach Program (C&O). For this internship, the student consultant will be mainly working with the CPA Program Manager, Lolita Gibbons-Decherong. The student will also be working with Heather Ketebengang of the Communications and Outreach Program to liaison with Denise from M&D Web Creations in order to implement any changes to the PCS website.

All employees have access to computer applications either through desktops or laptops. Each computer at the office is connected to the internal server where PCS data is stored. The main applications that are used by employees include Google applications (Gmail, Google Drive, etc.) and Microsoft Office applications (Word, Excel, Powerpoint, etc.). For virtual work and meetings staff members use Zoom. All employees are proficient with these programs and are able to sufficiently complete their tasks. Most of their proficiency in these tools comes from their experience. Employees do not have any formal technical training or workshops given to them as most work that is related to the website is outsourced to M&D Web Creations in Guam. However, all PCS social media platforms are managed by PCS employees. In addition, Heather Ketebengang from the Communication and Outreach program also uses tools such as Adobe Photoshop and online photo editing platforms such as Canva and other platforms to create and edit movies.

Furthermore, the employees conduct a great amount of their work through formal papers and physical folders. However, CMU's student consultant's work to develop a central platform to store protected areas information has helped centralize and digitize the data surrounding protected areas replacing the need to access a lot of older records.

Technology Infrastructure

All PCS employees have access to the internet whether through their desktop or laptops. They also have mobile phones at their disposal when they have tasks out in the field. However, it is important to note that access to the internet may be intermittent when PCS' employees conduct field work. It is also noted that power fluctuation in Palau can also be an impediment occasionally. The Communications and Outreach team is equipped with high end cameras in order to take pictures of conservation sites that are used for their personal data, but also promotional events and websites that support their outreach initiatives.

The Palau Conservation Society website is outsourced to M&D Web Creations in Guam, which offers web design services to small and medium startup businesses. Heather Ketebengang, is the only employee in the Communications and Outreach Department who is also the focal point between the developers in Guam and PCS employees. As the PCS' website is developed on Wordpress, PCS' employees have little understanding of the software so have to resort to an outside source for any work related to website development or technological tools.

Technology Management

There is no single member or technical lead that is responsible for technology management. Resolving technical issues is usually done on a program basis. If staff members face technical issues, they consult the program manager or other staff members to resolve the issue. If technical

issues require additional maintenance, PCS calls in local vendors who provide support. PCS employees use free antivirus software (primarily AVG) with installation and each employee is responsible for their own machine.

For any issues associated with the website which is developed in WordPress, Heather from the Communications and Outreach Program liaisons with M&D Web Creations in Guam who are responsible for the management of the PCS website.

Technology Planning

The program manager is first allocated a certain budget for each project by the Finance Officer. This budget is then signed by the Director of PCS and the Program Manager. Any technological needs that come up during the projects are budgeted directly from the project budget which takes into account technology maintenance. The budgets for projects usually have a separate amount designated for purchasing additional resources, however, the decisions are mostly under the Program Manager's discretion. If additional finances are needed for technology related purchases, the Program Manager communicates the needs to the Finance Officer and the Director.

Communication

Information sharing/communication takes multiple forms in the organization. Predominantly, PCS relies on person to person communication and the sharing of documents. Information online is communicated through mediums such as Email, Google Drive, and Messenger. Staff members also have access to their organization email accounts which are utilized for any business-related communication. Several employees also use WeTransfer for the sharing of files/documents online. Moreover, for external communication and virtual meetings the organization also uses Zoom and staff members are proficient in tools such as screen sharing, connecting via various devices, using wait room features etc.

For communicating with donors and individuals with inquiries, the website lists the organization's phone number, administrative email address, and email addresses of each individual staff member. Furthermore, donors are added to the organization's quarterly newsletter along with a final report that is sent out annually. In addition, the organization is also fairly receptive when communicating by phone. Overall, the organization has not seen extreme challenges in regards to day-to-day communication both internally and externally.

It is pertinent to note that communication with web developers is done through Heather which can often result in lost time as the developers are based out of Guam. As noted before, collection information/data from other programs can also be an impediment due to the lack of a centralized database and work load constraints on staff members.

Information Management

Information varies across the four programs but in general each program stores information related to the projects they undertake. Specifically for the Conservation and Protected Areas department, their information is collected in Excel forms, Word documents, and hard documents. Since the student consultant is involved with the CPA program, information that is collected by this department is background information on all conservation and protected areas in Palau. This information is collected through an application referred to as a “scorecard” in Excel. The scorecard includes the following information:

- List of protected areas
- Ecosystems and species that exist in the respective area
- Location of the protected area
- Terrestrial mass and marine mass of the area
- PAN Fund membership status of the area

The second critical information that is collected by the CPA department is the MPAME assessment tool which is used to assess and rate the management structure of protected areas. This information is also stored in an Excel spreadsheet. The final critical information collected by the CPA is a list of marine species that are protected at a state or national level. This information has recently been transferred to an Excel spreadsheet, however, there is some missing data as a lot of the information is scattered across different hard and online documents.

With the help of a previous CMU student consultant, scorecard information for the CPA department was organized and relevant data was centralized in the spreadsheet to provide a holistic view of protected areas in Palau. Sample data that is critical to the ‘scorecard’ includes species found in protected areas (Figure B), estimated cover of marine and terrestrial areas (Figure C) and individual protected areas information (Figure D). However, as protected areas information continues to get updated and more species are found or more areas get added to the protected areas network information on this excel sheet continues to get updated.

Name	Ecosystems or species included
Northern Reefs of Palau	Coral Reef (Barrier Reef)
Ngaruangel Reserve	Coral Reef
Ngkesol Barrier Reef MPA	Coral Reef (Barrier Reef)
Kayangel Territorial Waters	Coral Reef
Ngarchelong Marine Managed Area (NMMMA)	Coral Reef
Ongjil Conservation Area*	Coral Reef
Ngermasech Conservation Area*	Coral Reef (Reef Flat)
Ileaki El Belu Marine Conservation Area	Coral Reef (Patch Reef)
Bkulabelu and Teuachel Mlengui Conservation Areas	Coral Reef
Mokad Recreation Zone	Coral Reef
Oruof Ibachel	Coral Reef
Chiu (luul)	Coral Reef
Ngerchebal	Coral Reef (Reef Flat)
Ngemal Conservation Area, Ngilwal CA's*	Coral Reef (Reef Flat)
Ngermedelim Marine Sanctuary*	Coral Reef
Ngelukes Conservation Area, Ngchesar CA's*	Coral Reef (Patch Reef)
Medal Ngediul Conservation Area, Airai CA's*	Coral reef
Rock Islands Southern Lagoon (RISL) Management Area	Coral Reef (Barrier Reef)
Ngerukud Islands Wildlife Preserve	Coral Reef
Ngedrakk Reef	Coral Reef (Reef Flat)
Ngerkebesang Conservation Zone	Coral Reef (Reef Flat)
Ngemelis Island Complex	Coral Reef
Long Island Conservation Area	Coral Reef
Teluleu Conservation Area*	Coral Reef (Reef Flat)
Angaur Conservation Area*	Coral Reef (Reef Flat)
Helen Reef Reserve	Coral Reef

Figure B

Name	Approximate Size (Sq.M)	ESTIMATED MARINE (Sq.M)	ESTIMATED TERRESTRIAL (Sq.M)
Northern Reefs of Palau (Rayangel and Ngarchelong), cooperative marine	3900996434.04	0.00	3900996434.04
Ngarchelong Reserve	5652838.89	30.00	5652808.89
Ngatesol Bantier Reef MPA	109673668.95	563.00	109673612.95
Rayangel Territorial Waters	1522.00	3885.00	0.00
Ngarchelong Bird Sanctuary	330644.56	0.00	330644.56
Chemual Forest Preserve	15334.72	0.00	15334.72
Ngarchelong Forest Preserve	3384.94	0.00	3384.94
Ngarchelong Marine Managed Area (NMMMA)	2891325189.03	597.40	0.00
Ebol Conservation Area*	17811386.49	17811386.49	0.00
Ngarchelong Mangroves Conservation Area, Keradad Network	1671493.39	1671493.19	0.00
Ungafel Conservation Area, Keradad Network	14243.29	14243.19	0.00
Ngarkal Lake and Motmalasouch Watershed, Keradad Network	2226804.76	0.00	2226804.76
Dang Sra Ngarchok Conservation Area, Keradad Network	914779.30	0.00	914779.30
Ong-I Conservation Area*	3546588.28	3546588.28	0.00
Ngarchelong Conservation Area*	2930568.07	2930568.07	0.00
Reakl I Belau Marine Conservation Area	350446.84	350446.84	0.00
Ngarcheloban Ridge	206128.83	0.00	206128.83
Medal A Iyechad Waterfall	6129358.83	0.00	6129358.83
Ngarchelong Nature Reserve	8820548.98	0.00	8820548.98
Ngarchelong Bird Sanctuary	330208.79	0.00	330208.79
Ngarchelong Bay Conservation Area	118465710.13	118465710.13	0.00
Bulunggil Conservation Area	821010.19	821010.19	0.00
Bulabulau and Teaschal Mangal Conservation Areas	3118293.26	3118293.26	0.00
Makad Recreation Zone	224423.96	224423.96	0.00
Onaed Beach	314951.25	0.67	314950.48
Chud Chud	31096.90	0.26	31096.64
Oberakl	703196.27	0.52	703195.95
Inual Mangrove Conservation Area	855089.00	855089.00	0.00
Ngarchelob	791884.51	791884.51	0.00
Ngarchelong Watershed Conservation Area, Almelil CA's	3810171.81	0.00	3810171.81
Ngarchelong Conservation Area, Ngarchelob CA's	3043787.37	3043787.37	0.00
Obolotok Waterfall/Ngarchelong River Nature Reserve, Ngarchelob CA's *	1282683.77	0.00	1282683.77
Ngarchelob Nature Reserve, Melekeok	6465651.83	0.00	6465651.83
Ngarchelong Marine Sanctuary*	405108.86	405108.86	0.00
Ngarchelong Conservation Area, Ngarchelob CA's	5042586.98	0.00	5042586.98
Melekeok Conservation Area, Ngarchelob CA's*	1869136.75	0.00	1869136.75
Ngarchelong Mangrove Conservation Area*	1466827.00	1466827.00	0.00
Ngarchelong Conservation Area*	1844081.00	1844081.00	0.00
Dikali Mangrove Conservation Area*	253493.84	253493.84	0.00
Medal Ngarchelob Conservation Area, Almelil CA's*	3103282.87	3.17	3103283.50
Rock Islands Southern Lagoon (RSL) Management Area	796763647.85	748957847.59	478058328.26
Ngarchelong Islands Wildlife Preserve	11358423.06	10.64	11358412.42
Ngarchelong Spawning Area	4818991.60	4818991.60	0.00
Ngarchelong Sandrine Sanctuary	4985.27	4985.27	0.00
Ngarchelong Reef	5889948.88	5889948.88	0.00
Ngarchelong Conservation Zone	120112.12	120112.12	0.00
Ngarchelong Island Complex	40372471.11	0.00	40372470.31
Laja Island Conservation Area	230047.86	0.00	230047.86

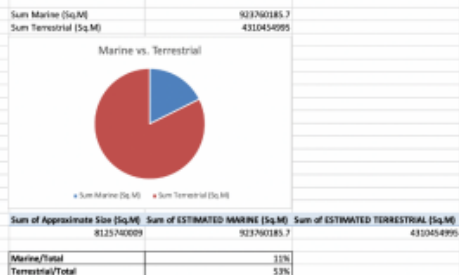


Figure C

PA Background		PAME ASSESSMENT RESULTS	
Name of Protected Area	Ngardok Nature Reserve (MP's Term: 2011-2014)	MC	Average of Score
Location of Protected Area	Melekeok State	Biophysical	17%
Date PA was established	31-Dec-97	Conservation effect	86%
Ownership details	Melekeok State Government	Ecosystem services	0%
Management authority	Office of the Governor	Enforcement	78%
Contact information	Tel: 654-2967/2728 E-Mail: melekeokgov@gmail.com	Finance	13%
Size of Protected Area (sq.km)	Est. 6.44 km2	Infrastructure/equip	67%
Percent of PA that is marine/terrestrial (%)	100% Terrestrial	Legal	73%
Number of staff (temp, permanent or volunteer)	15	Planning	92%
Annual budget	\$132,540.72	Socio-economic	58%
Designation (PAN, IUCN category, Ramsar, etc.)	PAN Use Category: Ramsar Site, IUCN Category:	Staffing	92%
Date of previous score card assessment		Stakeholder engagement	76%
		Traditional knowledge	100%
		Grand Total	72%

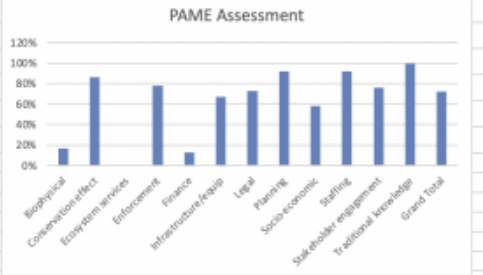


Figure D

Despite CMU's consultants' work with PCS, there still is no central platform or database to collect information that is uniform across all departments which makes it challenging to share information within departments. Furthermore, some staff members have experienced information loss and confusion within departments due to the lack of cohesion. By enhancing the management of information, the organization could see benefits in both operations and programs. Firstly, information sharing between departments could be done more efficiently, thus beneficial to the organization's projects. While each program has different projects and missions, there is data that

could be shared between programs. Furthermore, better information management adds value to the organization as a whole as they will be able to provide data and research that could be valuable for governments and other organizations.

Business Systems*

The finances and budgeting is managed by Nicole D. Maech. Until now, accounting has been done through an accounting software called Peachtree. This includes management of donations, payments, payrolls, taxes, budgeting for projects and resources, and other business operations. Donations by individuals are initially collected through their website which directs interested donors to PayPal. PCS also has an allotment program for organizations hoping to become Corporate Partners with the PCS. The Corporate Partner membership is acquired through a minimum donation of \$1000 annually. Different from individual donations, this allotment program can be done by directly contacting the organization. Overall, there have been no issues raised in regards to the business systems of the organization.

*Adapted from Curtis' report

II. Improve public access to protected areas information

Motivation

The conservation and protected areas program has an efficient information management system with all protected areas information stored in the scorecard that was developed by CMU consultant, Curtis Lee. This includes critical information about protected areas in Palau such as general information about the protected area, species or ecosystems found, location of the protected area etc. (detailed description in the information management section above). Primarily, Palauan students are interested in this information apart from several other segments of the population such as environmentalists, community developers, academia/researchers and the wider public. After talks with the global community partner, Lolita Gibbons, the problem highlighted is three fold: such information is not accessible online, not presented in a standardized manner or not updated regularly by the government or the protected areas network (PAN) office. Due to this, such individuals have to contact PCS for information regarding Palau's protected areas (including areas which are not part of the PAN). PCS then would disseminate this information either via paper documents/brochures, fact sheets or even PAN management plans (containing relevant protected areas information required) which are given in person (Figures E & F). All of this physical material which included over 40+ documents containing information around protected areas was located in the PCS office.



Figure E & F: Koror Fact Sheet which was handed over to students & Shelf containing hard copies of brochures, fact sheets and several documents which contained protected areas information

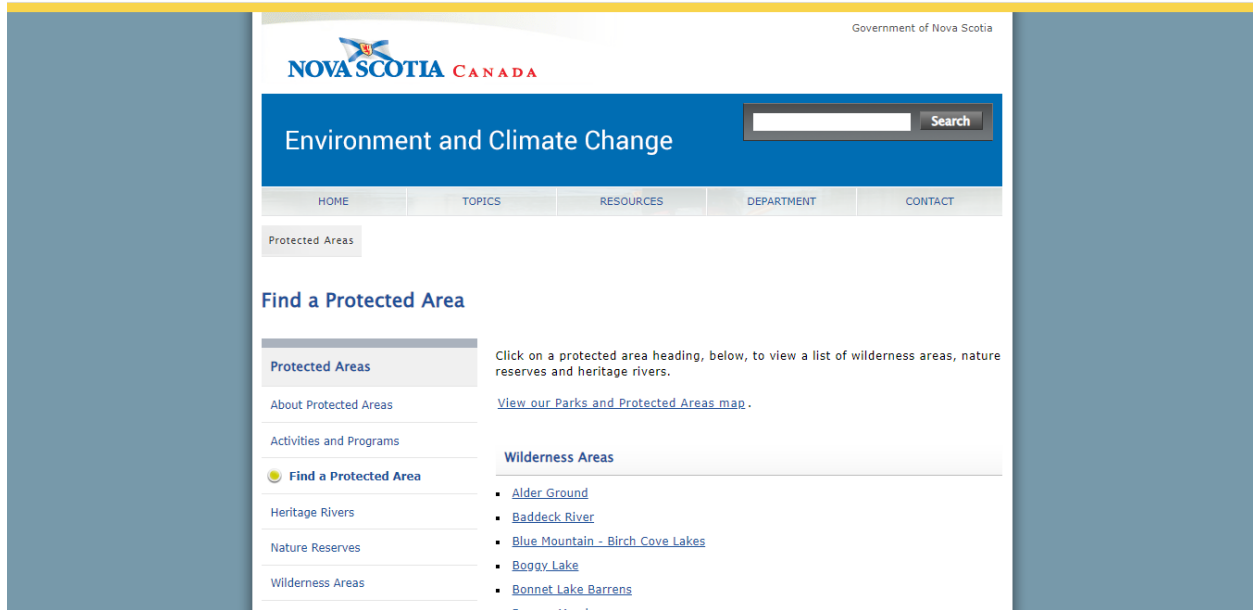
Considering this caveat, PCS wanted to make this protected area information (primarily information on the scorecard) transparent by making it available to the public on their website which is developed in WordPress so they can simply obtain all information from there and avoid having to physically come into PCS' office to collect it. The primary user group that this solution was targeted to were Palauan primary to college students. With the digitization of this process, students or members of the Palauan community would not have to show up physically to PCS' office which would not only result in delays but have various time constraints involved as well. Instead, all information would be accessible via a device online whilst also being available to a wider audience giving PCS an opportunity to showcase their conservation efforts.

There are several ways to go about achieving this goal. Primarily, making the information available online on the PCS website in a simplified manner (example Figure E) such that PCS can update this information (the PCS website is developed in WordPress and managed by M&D Web Creations) in the long run would ensure that the solution is accessible and sustainable. After extensive reviews of existing sample templates and several consultations with the global community partner and PCS employees, Figure E and F were seen as most suitable examples of what the sample solution should look like.

For added interactivity and accessibility of information, adding gif based maps or static maps obtained from the PAN management fund is also a viable option. To ensure the most optimal solution, the student consultant devised a plan to consult the website manager, Denise Ajimine of M&D Web Creations, interview user groups and continue research on possible avenues to reach PCS' goal.

Alternative solutions, such as choropleth maps or GIS based visualization were considered, however, such a solution wouldn't be sustainable considering GIS based softwares would require a

subscription and technical know how of running the program thus would not be sustainable to manage/update in the long run.



Source: <https://novascotia.ca/nse/protectedareas/map.asp> (Government of Nova Scotia Website)

Figure E



Source: https://novascotia.ca/nse/protectedareas/wa_alderground.asp

Figure F

Outcomes

Webpages showcasing protected areas information

As discussed in the previous section, after several consultations with PCS employees and the global community partner and reviews of several websites and alternate solutions, Figures E and F were seen as viable examples of how the information would be presented on the website. These examples were adapted from the Government of Nova Scotia's website which presents protected areas information in an efficient and accessible manner.

The first step to presenting protected areas information on the website was narrowing down the information that was most relevant to students when they would use the website. For this, the student consultant first met with Heather Ketebengang of PCS to understand how students and teachers interacted with protected areas data. Heather conducts various educational field trips with students and teachers and based on past experiences she helped identify information that is critical to users. This included the number of protected areas in Palau, type of each protected area and general information surrounding the area. Based on this, the following indicators were selected to be included as part of the website:

- Name of Protected Area
- State
- Ecosystems Included
- Year Established
- Mostly Marine or Terrestrial
- Approximate Size

Based on these indicators the student consultant normalized the data from the scorecard to extract the necessary information and display it in a worksheet (Figure G and H).

Name	Ecosystems Included	State(s)	Year estab.
Northern Reefs of Palau (Kayangel and Ngarchelong); cooperative management shared between the two states. Memorandum of Agreements entered into in 2014 for agreement to cooperate and 2017 for agreement to cooperate in implementation of Northern Reefs Fisheries Management Plan and Northern Reefs rules and Regulations.	Coral Reef (Barrier Reef); Channels; Spawning & Aggregation Sites (MPAs); Forest (Atoll forest)	Co-Management: Kayangel State and Ngarchelong State	2014 (Memorandum of Agreement entered into between the 2 states)
Ngeruangel Reserve	Island (Atoll island); Coral Reef; Lagoon		1996
Ngkesol Barrier Reef MPA	Coral Reef (Barrier Reef)	Kayangel	2012
Kayangel Territorial Waters	Island (Atoll island); Coral Reef; Lagoon	Kayangel	2012
Ngeriungs Bird Sanctuary	Bekai Micronesia Megapode; Bird Sanctuary	Kayangel	2012
Chermall Forest Preserve	Forest (Atoll forest)	Kayangel	2012
Ngerusebek Forest Preserve	Forest (Atoll forest)	Kayangel	2012
Ngarchelong Marine Managed Area (NMMA)	Coral Reef; Lagoon; Terrestrial; Island	Ngarchelong	2014
Ebiil Conservation Area*	Group spawning aggregations	Ngarchelong	1999
Ngaraard Mangroves Conservation Area, Kerradel	Mangrove	Ngaraard	1994
Ungellel Conservation Area, Kerradel Network	Mangrove	Ngaraard	2007
Ngerkall Lake and Metmellasech Watershed, Kerradel	Forest; Pond; Watershed	Ngaraard	2008
Dione Era Ngerchokl Conservation Area, Kerradel	Forest; Stream; Watershed	Ngaraard	2008
Ongiil Conservation Area*	Mangrove; Coral Reef	Ngaraard	2010
Ngermasech Conservation Area*	Mangrove; Coral Reef (Reef Flat); Seagrass bed	Ngardmau	1998
Ileaki El Beluu Marine Conservation Area	Coral Reef (Patch Reef)	Ngardmau	2005
Ngerchelchuus Ridge	Forest; Mountain vista	Ngardmau	2005
Medal A Iyechad Waterfall	Waterfall	Ngardmau	2005
Ngermeskang Nature Reserve	Upper Watershed; River; Forest	Ngaremlengui	2008
Ngermeskang Bird Sanctuary	Swamp forest; Forest	Ngaremlengui	2008
Ngaremeduu Bay Conservation Area	Estuary; Mangrove	Ngaremlengui, Ngatpang, Aimelik	1999
Eklengiil Conservation Area	Mangrove; Seagrass bed	Ngaremlengui	2000
Bkulabeluu and Teuachel Mengui Conservation Areas	Northside of channel; Coral Reef	Ngaremlengui	
Mokad Recreation Zone	Coral Reef	Ngaremlengui	2000
Oisadol Ibuche I	Coral Reef; Clams	Ngatpang	2003/2015
Chlul (Ibul)	Coral Reef; Crabs	Ngatpang	2003/2015
Oteruki	Coral Reef	Ngatpang	2003/2015
Imul Mangrove Conservation Area	Mangrove	Aimelik	2002
Ngerchebal	Island (Rock Island); Coral Reef (Reef Flat)	Aimelik	2006
Ngerderr Watershed Conservation Area, Aimelik	Forest	Aimelik	2008
Ngermai Conservation Area, Ngiwal CA's*	Coral Reef (Reef Flat)	Ngiwal	1997
esol Waterfall/Ngerbekuu River Nature Reserve, Ngiwal	River	Ngiwal	2009

Figure G

Protected Areas in Palau					
Approximate Size (Sq.M)	ESTIMATED MARINE (Sq.M)	ESTIMATED TERRESTRIAL (Sq.M)	Marine	Terrestrial	Mostly Marine/Terrestrial
3900936424.04		3900936424.04			Mostly Terrestrial
56592838.89	30.00	5092808.89	x	x	Mostly Terrestrial
109673608.95	163	109673445.95	x		Mostly Terrestrial
1522.00	1688	0.00	x		Mostly Marine
338644.56	0.00	338644.56		x	Mostly Terrestrial
13316.72	0.00	13316.717277		x	Mostly Terrestrial
3394.94	0.00	3394.940000		x	Mostly Terrestrial
2891525189.03	197.40	0.00	x	x	Mostly Marine
17811386.49	17811386.49	0.00	x		Mostly Marine
1671490.19	1671490.19	0.00	x		Mostly Marine
14243.19	14243.19	0.00	x		Mostly Marine
2226804.78	0.00	2226804.78		x	Mostly Terrestrial
914779.90	0.00	914779.90		x	Mostly Terrestrial
1646588.28	1646588.28	0.00	x		Mostly Marine
2930568.07	2930568.07	0.00	x		Mostly Marine
360446.84	360446.84	0.00	x		Mostly Marine
204328.93	0.00	204328.93		x	Mostly Terrestrial
6129358.83	0.00	6129358.83		x	Mostly Terrestrial
8920548.98	0.00	8920548.98		x	Mostly Terrestrial
338206.79	0.00	338206.79		x	Mostly Terrestrial
119457110.13	119457110.13	0.00	x		Mostly Marine
822010.19	822010.19	0.00	x	x	Mostly Marine
3118259.26	3118259.26	0.00	x		Mostly Marine
224423.96	224423.96	0.00			Mostly Marine
314931.15	0.67	314930.48	x		Mostly Terrestrial
353998.90	0.26	353998.64	x		Mostly Terrestrial
703198.27	0.32	703198.95	x		Mostly Terrestrial
855089.00	855089.00	0.00	x	x	Mostly Marine
7313844.51	7313844.51	0.00	x	x	Mostly Marine
3810171.01	0.00	3810171.01		x	Mostly Terrestrial
1043787.37	1043787.37	0.00	x		Mostly Marine
1282883.77	0.00	1282883.77		x	Mostly Terrestrial

Figure H

The second step included finalizing the design of the web pages that would showcase the protected areas information displayed in Figures G and H. After consultations with Denise Ajimine, Figures I and J were developed as sample design test pages that showcased a list of all protected areas by state with individual information of all protected areas. Protected areas were listed in a collapsible format for each state (an improvement in UI from the Nova Scotia website) so that each protected area is grouped according to a particular state.

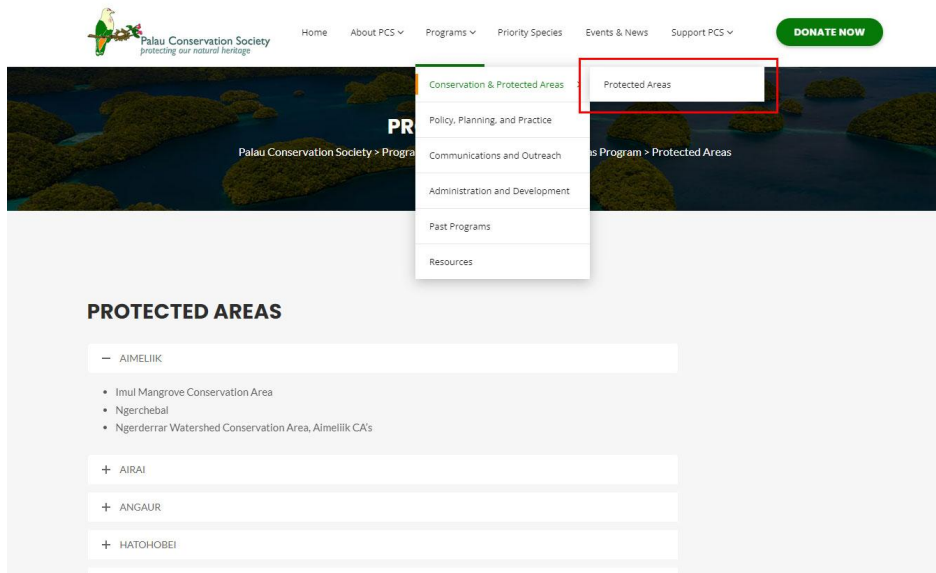


Figure I: Protected Areas list grouped by state

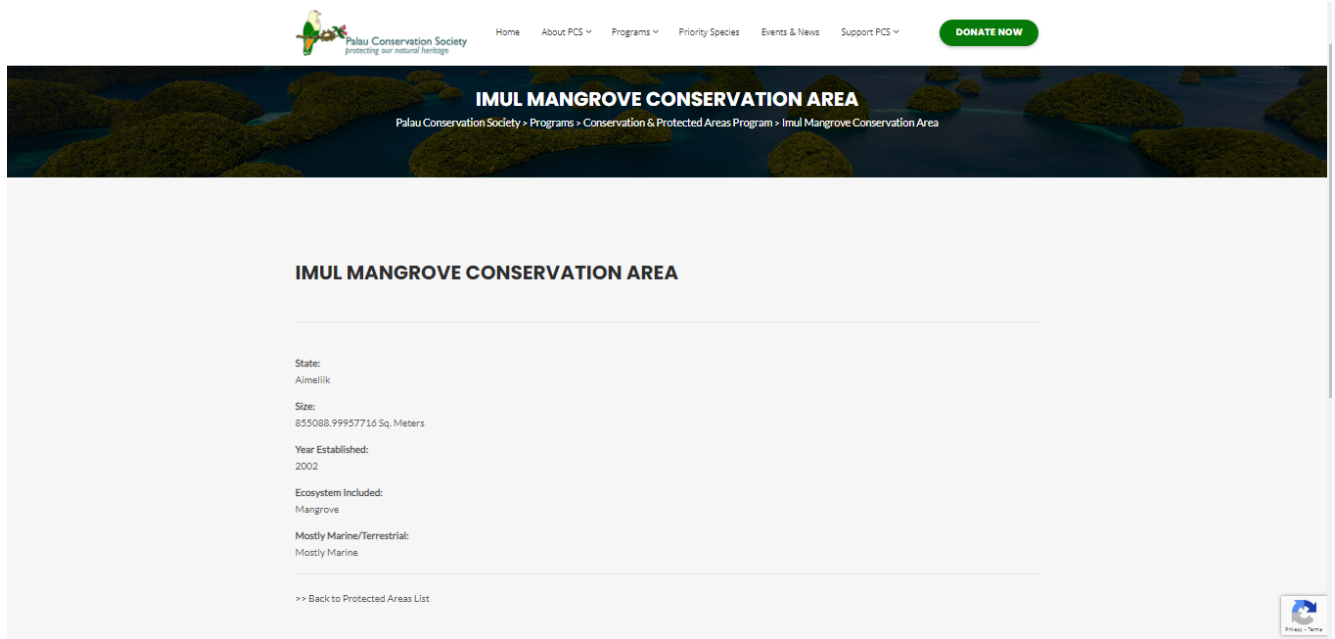


Figure J: Individual protected area page containing specific data as taken from the scorecard

With a preliminary design built, the student consultant met with several students and science teachers from Palau high school that would be the primary users interacting with the page/information (Figure H). This involved further understanding specific projects and assignments that the students had concerning protected areas information. Additionally, the teachers and students were shown and asked to interact with the design test pages to get user feedback. The students and teachers appreciated the ease in usability and structured manner of the information presented and suggested minor modifications.

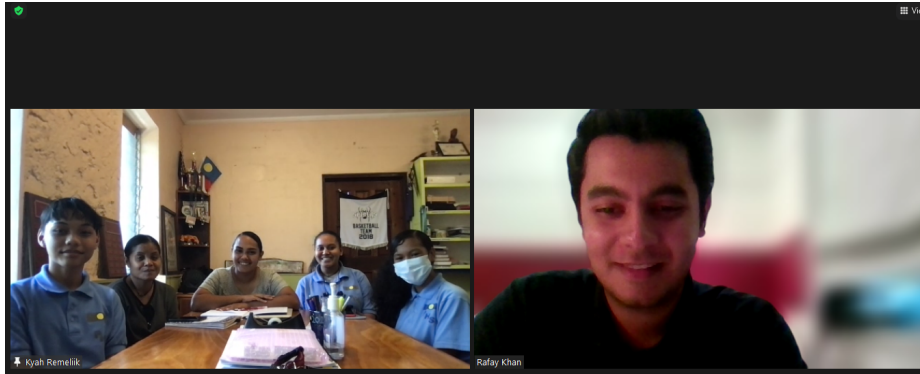


Figure H: Gathering feedback from Palau High school teachers and students

Adapting to their feedback and proposed changes, the final designs (Figures I and J) were approved. A description of the state and its protected area along with a picture was further added to ensure the solution is informative and aesthetically pleasing. The description of the protected area was taken by manually going through 40+ documents/pamphlets and physical material available as well as the PAN fund management plans. This design was adapted for all states in Palau and their 49 protected areas as available in PCS’ scorecard.

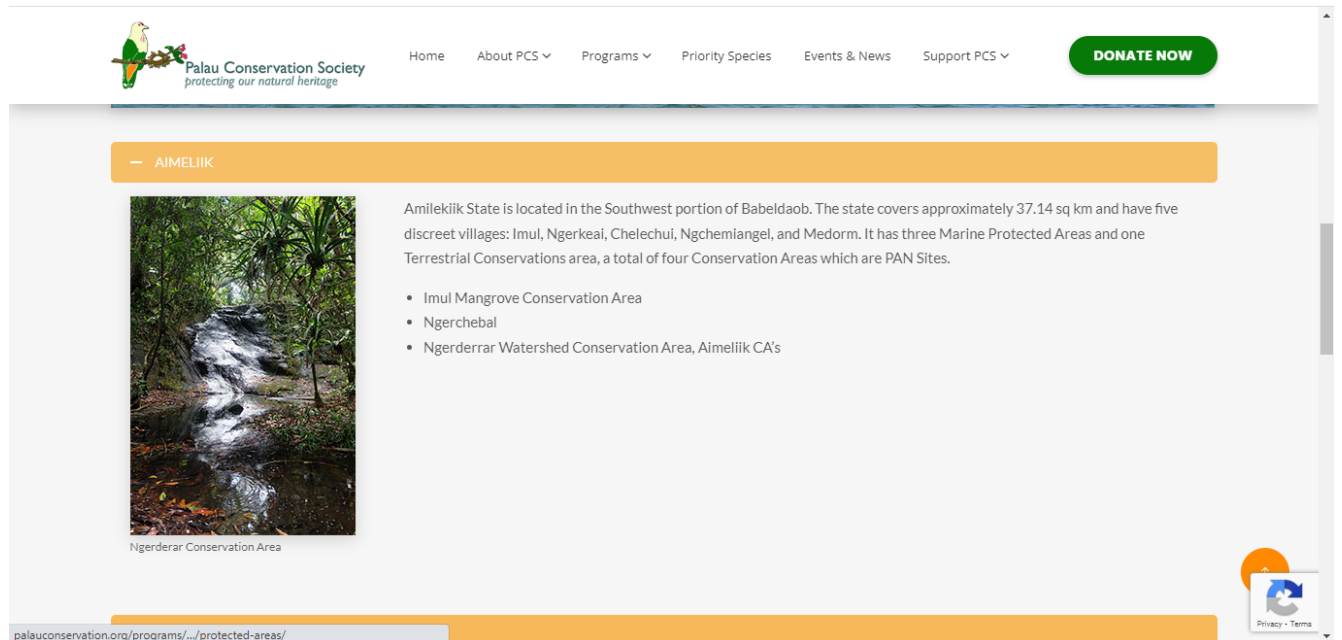


Figure I: Protected areas list grouped by state with textual description of the state and a picture.

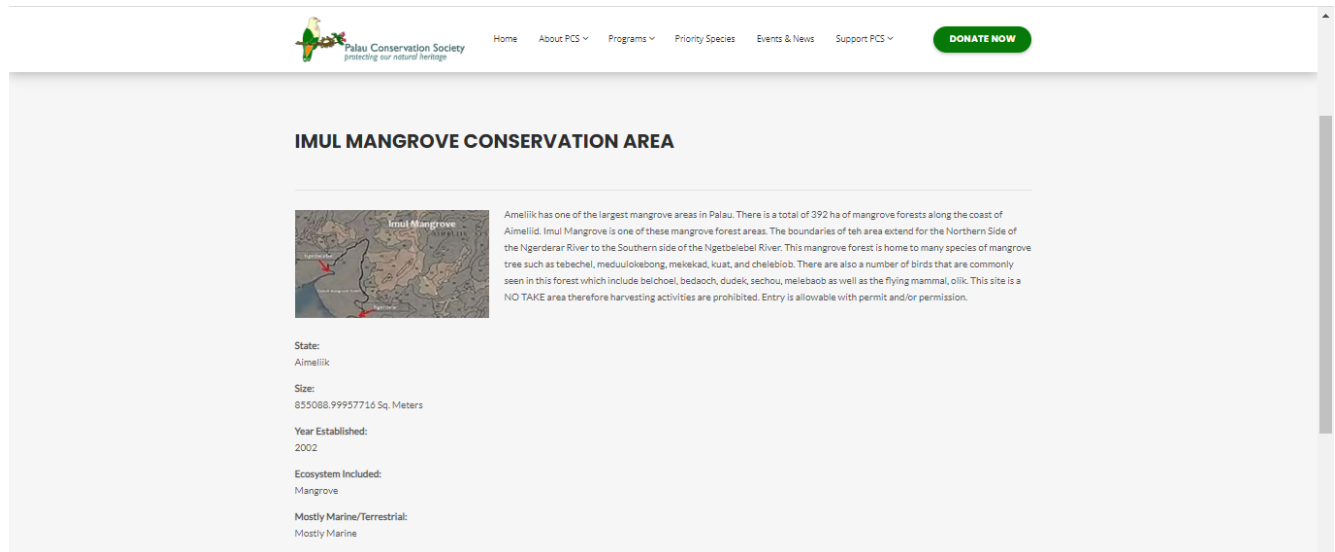


Figure J: Individual protected area page containing textual description of the protected area and an image.

At the time the project was concluded, a few states and their protected areas had information that had to be updated before the pages went live on the website. In addition, not all the states and protected areas had images for them. Hence, the student consultant had agreed with Heather Ketebengang that in the coming weeks Heather would collect images for these areas alongside a map of all updated protected area sites and send them over to Denise to update on the website. This would make the information more aesthetically appealing and further give the reader visual information about protected areas. The solution is in line with how changes are managed on the PCS website currently as well as as part of TCinGC's capacity building consulting model.

Recommendations

Continual updates on the PCS website

For the protected areas pages to be maintained it is important that regular updates be made to the pages to ensure information is recent. As mentioned in the previous report by Curtis Lee, it is expected that in the coming years there will be additional protected areas and changes to existing protected areas. Not only is it important that these changes be reflected in the scorecard to produce accurate analysis but also to ensure that this information is reflected on the website.

In addition to this, as more pictures are captured of specific protected areas and these areas are mapped it would be key to have these maps and pictures updated on these website pages. For this the student consultant has further discussed with Heather Ketebengang and the global community partner, to continue sending pictures and information to Denise for it to be updated on the website. It

would be helpful for PCS to keep a log of any updates made to the website to ensure that all changes are kept track off.

Work with the PALARIS office to map out protected areas

PALARIS is the Palau Automated Land and Resource Information Systems office which provides critical national spatial data services to government agencies and affiliates and supports the management of human, economic and natural resources of Palau. The Palau Conservation Society works actively with PALARIS for different projects including mapping protected areas, helping Koror state update fishery plans amongst other projects. One recommendation would be to harness this collaboration and work on obtaining GIS based visuals, choropleth and other interactive maps of protected areas as well as high resolution images for these new pages. This would not only ensure the information on the website is recent but it would add to the efficacy of the solution wherein policy makers, researchers and environmentalists could make better use of the webpages. Such updates to the solution would also enable PCS in enhancing collaboration with different branches of the national and state government offices that actively work with protected areas information.

Creation of a database to store protected areas information

Lastly, creating a database with protected areas data within the PCS website would not only help PCS store great amounts of data but it would update all this information in real time. The shortfall perhaps, is the lack of a technical lead within the organization to maintain such a database but an agreement with Denise Ajimine for the creation of a database can enhance the effectiveness and capabilities of the protected area pages with the potential of becoming a lead resource in Palau for any information related to protected areas.

About the Consultant

Rafay Khan is a senior in Information Systems with a minor in Public Policy and Politics at Carnegie Mellon University. He is passionate about consulting, digital transformation and international development.

Acknowledgements

The student consultant would like to thank Professors Joe Mertz and Julia Poepping for their help throughout the project. In addition, the global community partner, Lolita Gibbons-Decherong and other PCS employees for their cooperation and support. The student consultant would also like to thank Rania Khan for her assistance with information concerning marine protected areas and various conservation projects.