

# Lounigirun Barana Mebehati

## Tarufudun



## Budunudagei

Afãsehãti Robert C. Thigpen  
labu Elmer Mauricio Enríquez Bermúdez

Adibuhãtu luma Ilustrãritu  
Madison Hetzel



**LOUNIGIRUN BARANA MEBEHATI WAGIA.**  
**BUGUYA GE SUN!**

# Budunudagei

Afàñsehati

Robert C. Thigpen labu

Elmer Mauricio Enríquez Bermúdez

Sungu bai garüdia labu luyueri dimurei taburuchoguagüdü

*Lounigirun barana mebehati* [www.marinefrontiers.org](http://www.marinefrontiers.org)

© 2018: Robert C. Thigpen labureme bai sungu bai irichaü tani garüdia to. Siñati tagibedoguagüdü ni taburuchogu garüdia to labu ni aban luwuyerigu igaburi o saminaü sin lichugu abürühati irichaü lun ladügün Meriga.

Tidaüna guardia afàñsehati Madison Heltzel

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Mounwenbuduti hamuga wadagimani le, sin hideha umadagu tilana adamuri la Garifuna American Heritage Foundation United (GAHFU).



Tidaüna garüdia: Espátula Rosada (*Platalea ajaja*), Garza Cucharón (*Cochlearius cochlearius*), Gran Garceta (*Ardea alba*) Garza tigre gorjinuda (*Tigrisoma mexicanum*), gayaranti larihàuniwa ameragua, eibuga luma agaliruha üdüraü ha aganoubaña tabadünogua budunudagei. Adibuhatu: Madison Heltzel

The Mangroves  
By  
Robert C. Thigpen and  
Elmer Mauricio Enríquez Bermúdez

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GARIFUNA AMERICAN HERITAGE  
FOUNDATION UNITED



Cover: Roseate Spoonbill (*Platalea ajaja*), Boat-billed Heron (*Cochlearius cochlearius*), Great Egret (*Ardea alba*), and Bare-throated Tiger Heron (*Tigrisoma mexicanum*) can be seen resting, walking and hunting fish that live in the mangroves. Illustration: Madison Heltzel

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## **LIBIAMAN ATATIRAGÜLEI**

Lidan furumieti nakutiha labadünogua habübügüri asenihatiña lilana fulasu karibe, ayanuhati luagu wadagimanu aüdü, aüdu, awadigimarida úara hama asenihatiña lilana fulasu Balisi, ouserahamutina asenihatiña haduhe labu sun ken aban lilana fulasu, ken nalügüdoguniña lübügüri biología baranahana ayusureina siensiasi sosiales kaisi aban akutihati Merigana, gounabagületiña nun labu subudi luaguti ouchahani luma asenihani le meha hafurenderu bai hama wagüchagu. Sun furendei lira uti saragu hanichugu nun habügüri haduheñu labu amu luwuyeri asenihani luma ouchahani luma arufudahani lübügüri furendei le lurageirugu aüdü. Sin hamuga sun lira siña bai hamuga nafurenderu lübügüri wadagimanu sagü weyu lidan barawa.

Subuditi ekosisütema lira háun ouchahatiña habu sun ge asenihatiña kaisigirügü hasubudiruni aban umadaü, ladüga ñi hawadigimarida. Uguñe weyu, dagati lasansirogu lugaburigu dan hawagu sungu bai tabureme waporu to ñi lun bai hawadigimaridan asenihatiña hara, gadei lumuti sobreexplotación luma plastikos. Labu ligabirigu luyuwere dimurei luma siensiasi lani kadan aban aüdü lanina kadan aban fulasu ladügüwa tidiñeburi garüdia to lun gayaran lán gufarandahamani sugu bai luagu.

Ken le badügü aban wadagimanu goubaguñu tabu siensiasü luma manasi lani kadan aban fulasu, baduronguba luma saragu grabu labadünogua wadagumanu, baduroguba luma saragu grabu ken buri: dimurei yarafaguti luma amu dimurei lidan amu manasi, lidan kesi lira aban louserun dimurei iseri le giri bai (neologismos). Afiñetina buidu luagu wadagimanu le hadügü bai sungu bai ha afansehabaru hama ha asügüragüdubaroun garüdia to, labadünogua éibuguni le, wafurenderuña luaguti amüñegueinarügü manasi luma siensiasi lani kadan aban aüdü lidan kadan aban fulasu ubóagu. Lidan lagumuchaha wadagimanu le anuhein aban dimurei-agei labu dimurei iseri luma dimurei le güreiwai bai gufarandawa lán.

Utina saraguamuga háun ouchahatiña habu sun haduheñu labu haresibirunina habiebararugu, sin hamuga hagiya mounwenbuduti hamuga wadagimanu le. Utina ge saragu seremein háun wanigu ha awadigimaridunbaña wamá, sin hamuga hagiya mounwenbuduti hamuga ge wadagimanu le.

Lounigiru Barana Mebehati wagía sungua luagu, huguya ge sun guele!

Seremein,

Robert Thigpen

Ebudinaü

Lounigiru Barana Mebehati

## PREFACE

My first research in the area of Caribbean fisheries was largely informed by working as a side-man with the artisanal fishers of Belize [the western Caribbean]. The fishers treated me more like a relative from Cayo [an inland community] than they did a marine scientist from the states. Approaching my questions in marine biology using social scientific research methods provided a unique perspective through which I was able to learn about and from these fishers' ancestral knowledge (intellectual heritage). These experiences also gave me insight into things about their families, the local fishing mechanisms, and even the local education systems that I could not have learned without being immersed in their daily work at sea.

These fishers know the ecosystems in which they live and work intimately, indeed in the same way one is familiar with a close and trusted friend. Today the fisheries to which these fishers are so tightly related are being affected by external influences such as climate change, point source pollution, overexploitation, single use plastics as well as destruction of nursery and juvenile habitats to name just a few. While these fishers know these ecosystems well, their intellectual heritage does not fully account for these new negative external pressures, their causes, and the science describing them. These books are designed to blend local fishers' knowledge and their local languages with the language and concepts of science so they are better equipped to discuss these issues in the languages *they use*. In turn, the new concepts and words in the context of their home languages will help them communicate their strategies for protecting their families' food security and the marine ecosystems on which they depend in a clear and concise manner with fishery managers, policy makers, and conservationists.

When you set out to translate scientific constructs into what have been traditionally oral languages you run into many problems. One problem is that some of the terms have no equivalent words in the language(s) with which you are working. To overcome this problem, we've enrolled translators with cultural and linguistic relationship with the languages to create new words (neologisms) for these languages. They have done so using standard neologism methodologies. We are confident in our design and methodology, yet we are also learning as we go. We will continue to refine and standardize our approaches and procedures as we develop our next books: a conservation science publication, *Micro-Plastics in Our Environment*, and a bilingual dictionary of scientific terms and descriptions of flora and fauna. Most new words you find in the current Mangrove Ecology book are defined in the glossary. Those that are not in the glossary in this edition will be included in the bilingual dictionary and revised into a future edition of this book.

I would like to thank the fishers and their families for accepting me and allowing me into their lives. Without the education I received from these communities, this project would not have been possible. I also want to thank our international team of volunteers, were it not for them making these ideas a reality would not be possible.

Together we are Marine Conservation without Borders and now you are too!

Seremein,

Robert Thigpen  
Executive Director  
Marine Conservation without Borders

## HÀUN ARUFUDAHATIÑA

Buiti tachülüragüle garüdia to tidan amuñegueinarügü luyuwere dimurei tidan "Lounigirun Barana Mebehati". Aban ounwenbu ugundani lira wàun lun tachülürü arufudahani le hàun saragu irahüñü lun lisiñedu lounigirun barana hàun lidan sun ubóu.

Hàuntu irahüñu ha aturiahatiña lumagietiña 7º lun 9º ubunwarini.

Isûini. Le timan wabuserubai lun warufudaha lübügüri lounigirun barana. Saminatiwa ken lidehaba làn saragu larufudahàuniwa lidan amuñegueinarügü iñeñei. Saminatiwa ge ken anihein làn hamegeirun gürigia lidan amuñegueinarügü manasi. Ken buri, hasubudi gürigia lidan amuñegueinarügü luyuwere dimurei munada. Le timan busewa bai lun hasubudiruni alíhatiña lübügüri lounigirun barana mebehati.

Idaluba wayusurunoun garüdia to? Aban tadügüniwa garüdia to lau aban idiñeburi lun hawadigimaridun arufudahatiña tau tidan amuñegueinarügü iñeñei lau sun tidan saragu luban fureindei, mosu hachoruruni anuhànbou làn aban aban tidangie garüdia to hama kadan aban aturiahatiña.

Anihein saragu isûini lidan ariñahani le bürüwabai lidan kada aban lidangie tubana dandu lidan merigen kaisi lidan asibañulu. Gayaranti banuhadiha lun barufudaha tau kadan aban tidangie to babuserun.

Lau aban abusuruni latarira kadan aban lidangie arufudahani le tidanbai. Barüti aban saminaü lumagua lun gayaran bai làn lasigenehàuniwa lau saragu isûini. Moso labahüdüniwa pisonon lau amuñegueinarügü bokabulariu, afànsehani tau afànsehata dimurei, lidan amu kaisi anhein úatu bai bideu.

"Ha hisiebai osèano ani hisieti hàun. Güreweibai hasaminarun madan làn nei osèano habagari."

**Hermann Broch**

Seremein luagu haresibirunoun garüdia to luaguti lafurenderuniwa lounigirun barana. Ideroguahumawa lun abuidudeina tan tilana garüdia to igiragüdeina murusun minutu lidangie hidani lun hàunabunei alügüdahane le ya bai, badairuba aban koreu ünabu lun bounahani aunabagülei lani alügüdahani.

Seremein! <http://www.surveymonkey.com/r/MCWbencuestalibrodelectura>



## **A WORD TO THE TEACHERS**

Welcome to Marine Conservation without Borders multi-linguistic educational resource. We are delighted to have you on board with us in this global effort to teach our children and youth how to love and protect our marine resources for the future.

This material is recommended for 7<sup>th</sup>-9<sup>th</sup> grade students.

**Objective:** Our primary goal is to teach marine stewardship. We believe that education will benefit by multilingual delivery. We believe various speakers have various needs. Accordingly, we appeal to people within their familiar and formative home language experiences. Our various readers are already stakeholders in the present and future quality of our marine resources, so it is both important and appropriate to communicate directly with all users.

**How to use this material:** These booklets are meant to be a foundation to guide the teacher/student classroom pace and settings. Feel free to adapt them to accommodate your location and resources. Make sure that each student has their own copy.

Each page presents a short lesson containing the same information written in both English and Spanish. You may choose to teach one language or the other, or both if it seems suitable to you.

Always begin each lesson with a positive, encouraging greeting, and an interesting fact related to the theme or topic of discussion. Prepare the materials and the board ahead of time. The board should include the new vocabulary, the e-links, the topic/theme, and poster images in case you have no internet available to display a video.

“Those who love and live by the sea can hardly form a single thought on which the sea would not be a part.” — **Hermann Broch**

Thank you for downloading our conservation education materials. Please take a few minutes to take a survey for us to help us improve our conservation educational instruments. We would also appreciate any additional comments you might have after using our material. There is an email address at the end of the survey to send us additional information. Thanks!

<https://www.surveymonkey.com/r/MCWBreder20170409>

## ATATIRAGÜLEI GARINAGU

Larigi naweyadu Seine Bight, Balisi, lidan labadünogua ni ñüraü, arihanumuti meha tidi nagütü ouchaha sagü weyu wabiebararugu laru beya lun gayaran lán héigi sungu bai tibaña, uguñe weyu arihanali ken mosu lán héidi ouchahatiña dise luéi laru barana lau sun lun hawadigimaridun lau aban lidere lun gayaran lán hañugu murusuraü üdüraü, memegi louguaña üdüraü hama hógawarü hañugu ouchahatiña. Sun han dan lidan gie lán barana lahücha héigi garinagu labu sun saragu lidan gie hafisiyute lau sun gounigilaniña barana, lidan gie barana liabi lisüuini katei labu sun ha sifiri garinagu, ani lidan gie lira weiga labu sun gounigilawa luéi lagübüri le lanügü bai lagumuchagüdüniwa katei le habiebararugu bai garinagu, ken buri: lasansirogu ligaburigu dan luma kontaminación luma plastiko, Chülüha dan lun gayaran lán wounigiruni barana ladüga uhali saragu ibagari woun luagu saragu dan.

Lounigirun Barana Mebehati, aban ounweunbu wadagimanu le gayaran bai lideha laru beya wabie bararugu, lun gayaran lan lounigirun laru beya labu sun laru barana naturalüti wabie bararugu. Ken la lîháuniwa lidan fulasu digitalü tidan afánsehatu dimurei, "Weiriti lacharogu subudi lidan kadan aban luyuwere dimurei lübügüri ekosisütema le geyegu bai lau." Ken Uruwái luma Atatiroguagüdütu Adamuri Fundación Unidos para la Herencia Garifuna Americana, Aban busiñe nan nachorurogu nungua lun buidu lán representarühama Garinagu lidan ounwenbu wadagimanu le; ligía aban lun bai wichugu idemu lun lasügüragüdüniwa wadagimanu le lidan Garifuna. Larigi sun lira aban waguaragüdü lumagiñe Labugagie Wadimalu luagu, Arufudahati Elmer Mauricio Enriquez Bermudez.

Mamarügügili tuma GAHFU lawadigimarida arufudahati Enriquez, kaisi arufudahati labu luyuwere dimurei lidan garifuna lidan irumu 2015-2016 tidan Akademia Garifuna lani Luyuwere dimurei luma Manasi labugiñe idemu le tichugu bai Alianza para California de Artes Tradicionales, awadigimaridali ge labu labürüdü naün garüdia to giri bou "Fureindei Wamá Abürüha Ayanuha luma Alîha lidan Garifuna, tidangietu Editoriales C&J'J Enriquez" (Aprendamos a escribir, hablar y a Leer en Garifuna, Parte de Editoriales C&J'J Enriquez). Lun wadauruni afareinhani le huma lübügüri wadagimanu le, GAHFU labu aban idemu úara tuma Lounigirun Barana Mebehati hasigiruña labu hawadigimari lun lounigiru luyuwere dimurei luma manasi garifuna.

Harisi saragu lilana amüñegueinarügü manasi barana ani wadasi kadan aban wadangie lun wounigiruni haba hasanigu warahüñü. Uhuma chansi woun lun wawadigimaridun úara lübügüri lounigirun barana lun gayaran lán wigiruni lau ibagari haba wasânigu lau sun haba wabaña.

Seremein,

Au le Mámaga (Cheryl L. Noralez)  
Garifuna American Heritage Foundation United  
garifunaheritagefoundation.org

## **GARINAGU INTRODUCTION**

As a child growing up in Seine Bight, Belize my grandmother in the village would go fishing every day to provide food for us grandchildren. I realize today that the fish are fewer and that fishermen have to travel farther and work harder to catch less fish and lobster. The sea has always been the life blood of the Garinagu by feeding and protecting us. The sea is an essential part of our spiritual well-being. With the challenges of overexploitation, climate change and plastic pollution it is time for us to protect the sea that has given us life for so many generations.

Marine Conservation without Borders (MCwB) is a wonderful project that is much needed in our coastal communities for the preservation of our natural environment and to protect our food security. Stated in their website: *Languages contain complex understandings of a person's culture and their connection with their surrounding ecosystems.* As President and Founder of the Garifuna American Heritage Foundation United (GAHFU), I wanted to make sure we Garinagu are well-represented in this project. We decided to join forces with MCwB in the translation of these educational materials into our beautiful Garifuna language. We recruited one of our youngest and foremost Garifuna scholars from Labuga Livingston in Guatemala, Professor Elmer Mauricio Enriquez Bermudez. Professor Enriquez has worked with GAHFU as a Garifuna teacher during the 2015-2016 Garifuna Language & Culture Academy online sponsored in part by the Alliance for California Traditional Arts, he is also the author of several Garifuna publications in Guatemala such as *Furendei Wamá Abürüha, Ayanuha luma Aliha Lidán Garifuna* (Let's Learn to Write, Speak, and Read in Garifuna).

In closing, GAHFU will continue to collaborate with Marine Conservation without Borders as they continue their mission of creating and disseminating conservation science educational instruments in the mother tongues of the fishing communities of the greater Caribbean basin in order to preserve these important ecosystems for our future as well as helping protect and preserve these languages and cultures of the region including the legacy of the Garifuna.

The sea is the heritage to many different peoples and it our responsibility to protect it for our children's children. Let us all work together to leave it full of life and resources for our children's and grandchildren's future.

Seremein,

Au le Mámaga (Cheryl L. Noralez)  
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# BUDUNDAGEI- LOS MANGLARES

## Konektibidad luma Ambiente 1

Tilana: Budunudagei-Hàbiebararugu Naturalüti

Lisûini: Lasibihàun Alñhani

Iseri Dimurei: Budunudagei, Ekosisütema, Hàbiebararugu labugie barana, Dunuru Limíkola, Dabutagu.

**Iarani Iani Saminaü Aganihagületi:** Aban lacharogu budunudagei ken aban ekosistema lougiñe luma labugiñe laru duna. Lougiñe budunudagei haganowa dunuru ha larurugubaña duna o barana, huti ge lun lameraoguniwa larigi aban weyu dereti larigi adiyahani o asenihani. Huti budunudagei hàun dunuru lun hagüriaha luma ge lun hàunigiruniña harahüñü dunuru, siñabei hamuga haganoháun dunuru ni hagibedogu ahein úa budunudagei larurugu duna ni laru barana.

### **Alügüdahani**

1. Ka lidangie ekosisütema gadantan budunudagei?
2. Ka timan habiebararugu bai dunuru limíkolos?
3. Halia hagüriahàuwa luma haganowa dunuru limíkolos?
4. Según bisamina, ka hèigi bai dunuru limíkolos?

### **Chubalügüni**

1. Larigi tafànsehàuniwa wadagimanu lele aban me badibuhani habiebararugu dunuru limíkola-budunudagei-aban me barufuduni megeihamani dunuru ha habagaridu lidan ambiente lira arâbu. WADAGIMANU-aban me badügü aban kollage lun badibiragüdünoun turageirugu luban furendei.
2. Anhein yarafalunbai baganowa luèi budunudagei, aban me bariyoguni buidu lun badibuhani le barigibai.

## Connectivity and the Environment 1

Theme: Mangroves-Natural Habitat

Objective: Reading Comprehension

New Vocabulary: Mangrove, Ecosystem, Underwater Habitat, Wading Birds, Rookery

**Critical Thinking Skills:** Mangrove swamps are complex ecosystems with plant structures both underwater and above the water surface. The above water part of mangroves is a principle habitat for wading birds. These branches provide, safe places to sleep and rest after a long day of hunting. The mangroves are also places for wading birds to have babies and rear their young (rookeries). Without the mangroves, these birds will have no place to live.

### Questions

1. What type of ecosystem do mangroves belong to?
2. What is the principal habitat for the wading birds?
3. Where do the wading birds nest and have their babies?
4. What do you think these birds feed on?

### Activities

1. After discussing the questionnaire with the class, draw a picture of the natural habitat-mangrove- of the wading birds. Show how these birds depend on this particular environment to survive. **Extra/** Change the picture into a collage for display in the classroom.
2. If you live near a mangrove, visit the area and write a detailed description of what you see.



Sun harutiña beyabuna o dunuru pihuiú (*Tringa semipalmata*) hama amu dunuru beyabuna ha chati bai ha piku (*Limnodromus griseus*) ken barihiniña tidan iyawaü tura, hameraguña larigi hëigi tarurugu budunudagei lidan ünabu làn barawa. Higiri Garadun, Choluteka Huliliga ligía liri bai fulasu ñi lun bai tadiraruwa iyawaü to.

These Willets (*Tringa semipalmata*) and Short-billed Dowitchers (*Limnodromus griseus*) are taking a rest from feeding in the mud flats that are exposed during low tide. Location: Punta Ratón, Choluteca, Honduras. Photo: Oliver Komar, Zamorano University- Panamerican School of Agriculture.

## Konektibidad luma Ambiente 2

Tilana: Budunudagei-luma Gasi Fósilesü-CO<sub>2</sub>

Lisûini: Lasibihàun Alîhani

Iseri Dimurei: Dióksido lanina Gàrubu (CO<sub>2</sub>), Lasansirogu dan, Asidifikasiún lani Osèano, Gadurunti, Gasi, Fósilü, Lagiribudagun erèi.

larani lani Saminaü Aganihagületi: Chulumuti budunudagei sun dióksido lani garubun (CO<sub>2</sub>) ani aban lagibedogu oxígeno (O). Lasansirogu dan lidan magurabaháwu lán, ligía aban lidangiñe katei le agadeirubali barana lau sun duna ani ligia agadeirubali ubóu uguñe weyu, abaya katei le agadeirubali subudiwati ken (CO<sub>2</sub>), lidangiñe lagüdaháuniwa gasi fósiles lahücha, ken buri ge golu wuriti luma garubun. Megeitiwa lun lougua lán wamenigidu luagu gasi fósiles lumageti lun watatiru ousera erei le gayarati lahüchü leweñogua gasi le agadeirubalin ubóu. Luagu bai hamuga mouseruwaman gasi fósiles haruga, aniheinguame saragu CO<sub>2</sub> ubóagu. Aban tidangiñe garada to tahureragüdübou budunudagei, ken sun nadü, lun tatu CO<sub>2</sub> larigi aban tagibedoguduni O. Sun budunudagei sagatumuti C lidangiñe garanibali le wawaragu bai larigi aban louseruwa ken eréi. Buitu sungu bai budunudagei lun wadagimanu lira, ligía megeiwabaru lun wabagaridu lidan darangilaü.

### Alügüdahani

1. Idaluba lasibihàun asidifikasiún lani sungu bai osèano?
2. Idaluba lañahurihan saragu CO<sub>2</sub> tun budunudagei luma lun ambiente?
3. Idaluba wideha lun wounigirunoun budunudagei?

Chubalügüni: Gayaranti hayusurunoun internetü lun haluahan bideu tani budunudagei 5 o 10 irumu anagagion, aban me konpararü humanoun tuma tuma budunudagei to lidan bou dan le. Larigi sun lira aban me hafànseha hama anigu tidan luban furendeï lübügüri aban me ge hàunaha aban garada hàun gumadimatiña lanina fulasu lübügüri le hadairu bai.

## Connectivity and the Environment 2

Theme: Mangroves-Fossils Fuels- CO<sub>2</sub>

Objective: Reading Comprehension

New Vocabulary: Carbon Dioxide (CO<sub>2</sub>), Climate Change, Ocean Acidification, Fossil Fuel, Renewable Energy

Critical Thinking Skills: Mangroves also take in carbon dioxide (CO<sub>2</sub>) and produce oxygen (O<sub>2</sub>). A pressing issue of modern times is climate change, which is increasing temperatures globally and is also causing ocean acidification. One of the principal causes of climate change is an increase of CO<sub>2</sub> in the atmosphere and oceans. The increase is produced by the burning of fossil fuels, such as oil-based products and coal. We need to reduce our dependence on fossil fuels and begin our transition to renewable energy sources. Even if we were to stop using fossil fuels tomorrow, we would still have a lot of extra CO<sub>2</sub> in the atmosphere. CO<sub>2</sub> in the atmosphere captures heat from sunlight. In the ocean CO<sub>2</sub> makes the water more acidic. One important role of mangroves, like all plants, is to take in CO<sub>2</sub> and produce O<sub>2</sub>. Mangroves take the carbon (C) out of the air we breathe and use it for energy. Mangroves are very efficient at capturing C, so we need to protect mangroves.

### Questions

1. How would you describe acidification in the oceans?
2. How does excess of CO<sub>2</sub> affect the mangroves and their environment?
3. How could we help protect mangroves?

Activities: Use the internet to find a video of the natural mangrove surroundings near you from 5-10 years ago and compare it to today. Discuss the differences with your classmates. Try to send a letter to your local authorities pointing out your findings.



Sun arâbu le ñi tubai budunudagei Kartagena lani Indias, Wewerugu, mamarügüñei darangilaü hichiga hàun asenihatiña hama ouchahatiña, utiña ge laruman garabali hàun animalu baranahana ha busebaña lun hawanseru. Harumagüdatumuti ge gârubun larigi tasügürü saragu karü tuma busu ñigiñe. Según Robby Thigpen.

These mangrove forests near Cartagena de Indias, Colombia not only provide homes for local artisanal fishermen, but also provide a healthy ecosystem for the sea creatures these fishermen need to catch. In addition, mangroves also clean the carbon from the exhaust many cars, trucks, and buses in the city.

Photo: Robby Thigpen

## Garifuna Konektibidad luma ambiente 3

Tilana: Budunudagei-Ekosistemas

Lisûini: Lasibihàu Alîhani

Iseri Dimurei: Invertebrados, Moluskos, Sustrato, Kolapso

Irani lani Saminaü lani Aganihagülei: Aban ekosistema labugarügüti sun lacharogu ilagülei labugie duna. Idehati sun budunudagei lun gayaran bai lan haramudogu sun harahüñü üdüraü labadünogua hau sun amu nadü le labadünoguabei. Gayarati ge hameiliha luma lun háigi labadunogua budunudagei, kenburi pargo gürisi. Sagü aban hadangie animalu ha aluguruwatiña karibe ani abagaridatiña lau sun ge aban weiyasu tabadunogua budunudagei lau sun arâbu. Anhein uwa budunudagei tau sun pradera baranahana, larairuhamuga asenihani.

Alügüdahani

1. Lafansehàuniwa: kà làn afurenderuwa bai lübügüri ilagülei le labugie bai duna?
2. Kà bisaminan bai luagu hagoubadagu bai moluskos luma sustrato?
3. Bafareinha lau murusu abürühani, kà làn wagu siña lun bai wagu siñabai lubai habagaridu asenihatíña hama ouchahatiña sin budunudagei tuma praderas baranahana?

Chubalügüni: Akutihaba lidan bubie bararugu atiriñanu làn pargu baligi hama amu animalu baranahana áigiwatiña. Aban me babürüdüni atiriñanu làn haluguru lidon fulasu terenchana, hebegi, luma atiriñalu làn alugurutiña luagu weyu.

### Connectivity and the Environment 3

Theme: Mangroves- Ecosystems

Objective: Reading Comprehension

New Vocabulary: Invertebrates, Mollusks, Substrate, Collapse

Critical Thinking Skills: The underwater root system of mangroves is a unique ecosystem. Mangroves add lots of cover for small fish and invertebrates and substrate for mollusks and other organisms. This system is also an important nursery area, a juvenile habitat, and a feeding area for many commercially important fish species such as the gray snapper (*Lutjanus griseus*). Every commercially important species in the Caribbean spends at least one phase of its life in the mangrove roots and/or in the seagrass meadows. Without the mangrove and seagrass meadows, all fisheries of the Caribbean will collapse.

Questions:

1. Discuss what you understand as a “underwater root system”.
2. Why do you think mollusks attach themselves to the substrate?
3. In your own words, explain why the fisheries of the Caribbean would collapse without the mangroves.

Activity: Conduct a research on your city to find out how much dependence there is on the consumption of red snapper (*Lutjanus purpureus*) or any other special species of fish locally. Include these topics: availability, average cost, import, export, quality, restrictions, and demand.





Sun harahüñü pargu (*Lutjanus apodus*) afulihatiña labadünogua tilagüle budunudagei funatu lun h aluaha èigini (*Rhizophora mangle*). Ha ñübürigiña *L. apodus* aban hèigi harahüñu animalu ken buri: hürü hama anfípodos ha aganowabaña labadünogua ilagülei. Gayatanti ge hafulihan furese labadünogua tilagüle budunudagei luèi hèiginiña amu üdüraü weinamutimatíña. Gayaranti hadairuniwa Balisi, iyawaü: ©Antonio Busiello.

These juvenile Schoolmaster snappers (*Lutjanus apodus*) swim among these Red Mangrove (*Rhizophora mangle*) roots looking for food. Juvenile *L. apodus* eat small crustaceans like crabs and amphipods that live on the roots. They can also swim quickly into the root system to avoid being eaten by larger fish. Location: Belize Photo: ©Antonio Busiello

## Konektibidad luma Ambiente 4

Tilana: Budunudagei-Lagumuchogu

Lisûini: Lasibihàu Alîhani

Iseri Dimurei: Lagumuchogu, Marehada Luriban dan

Irani lani Saminaü lani Aganihagüle: Adüगतuge budunudagei amu wadagimanu. Gounigitumutu ubouhu luma kontinente larigi lagubahanei hiriri luma amu luriba dan. Itaraliña budunudagei ken amu luwuyeri ilagülei. Idehati lun lagüdahouniwa mua lun uwaragua lan luma geti ideha lan budunudagei luei labouhan laru duna luma laru beya ken here lan lugudi barawa lau sun ken wariba lan ligaburi dan.

Alügüdahani

1. Idaliña bisaminan lübügüri ligaburi tañawuriha tagumuchogu budunudagei ladüga luriba dan laru barana?
2. Idaliña bisaminan luagu idaluba làn lideha wügüri luèi tagumuchogu laru barana?
3. Reidehadibu ken anihein làn luriba dan laru beya?, Kàba gi dimurei bayusura lun bayanuha lübügüri?

Chubalügüni: Adügaba aban tagei iyawaü lau amuñegueinarügü budunudagei le laru bai, barana lidan sun ubou. Aban me bachoruruni budunudagei le bubiebararugubai. Arufudabai idanliñameha làn lubaragie luriba dan 10 irumu lubaragie le.

## Connectivity and the Environment 4

Theme: Mangroves-Erosion

Objective: Reading Comprehension

New Vocabulary: Erosion, Storm Surge

Critical Thinking Skills: The mangroves also have another function. They protect the islands and mainland from erosion caused by hurricanes and other storms. The roots of mangroves are just like other root systems: they help hold the soil together and fight erosion. Another issue with storms is tidal storm surge. This occurs when the sea is pushed onto the land by tides and low atmospheric pressure. Mangroves help to protect islands and the mainland from this rush of seawater, erosion, and other problems associated with storm surges.

Questionnaire:

1. How do you think erosion affects the mangroves near the seashores?
2. Do you think humans can help the coast from suffering erosion? How?
3. Have you ever been in a storm at the seashore? What words could you use to describe it?

Activity: Make an album with pictures of different mangroves in coastal zones around the world. Be sure to include yours. Show the “before and after the storm” scene. Compare also with pictures from some 10 or more years ago.



Aban tarihi Barbara luma Jonny aban fulasu laru beya ñi lubei chaunwaru lan budunudagei. Maruhali beya ni laru duna ani siñahali hafamuchu gadaru ñi lun hichaha gaañein. Barbara Barrera Vilarmau luma Johnny Hurtado Aguilar, hagia ichugudinaübaña lun aramudoguni lani ibagari dunarugu luma baranaha Upiano lidan duna karibe Costa Rica. Labadunogua hadani gadaru, agararahatiña ariebu tidan ugunei lun hounigirunou haggaañei gadaru hawei eibahatiña gadaru. Aban ha pakühanoun luma ge hounigihanou haggaañein gadaru dari lun hafugachu. Hutu ge budunudagei lun amuñegueinarugu katei ken buri: Hàunigiruni ubou luèi lagumuchogu ladüga harabaganali, lerouga luma amuñegueinarügü luriba dan. Idehati tilagüle budunu dagei, lun taundaruni mua labu sun sagou, luèi lachibu mua labu sagu baranaha ken ñi làn harabaganali le hèreti. Ken liabi harabaganali agoubaheina luma barana, lasuseredubai lira ladüga aban ladaruni garabali barana lau èrei luma oufuni larurugun. Ñi labelura tuwadigimari budunudagei lun tideha luèi lagumuchogu laru beya luma laru duna. Lagubahabei laru beya luma laru barana sagü liñuru lugudi barana ladüga lasansirogu lugudi ani sun lira denchati hàun gadaru lau sun woun keisi girigia uboagu. Labürüdü: Robby Thigpen.

Barbara Barrera Vilarmau and Johnny Hurtado Aguilar are the overseers of Refugio de Vida Silvestre Laguna Urpiano on the Caribbean coast of Costa Rica. The coastline has crept in so far that sea turtles cannot lay their eggs in this protected area. During sea turtle nesting season conservationists perform nightly sea turtle patrols to protect the eggs from poachers. These heroic people relocate any eggs they find into areas safe from poachers and watch over turtle eggs until they hatch. Erosion from the removal of mangroves and erosion from climate change induced sea-level rise, are serious threats to sea turtles and communities across the globe.

## Konektibidad luma Ambiente

### Hanichugu lani saminäi

Anhein hamuga tanchuguwa sungu bai budunudagei idalubagi lasandiruniwa sansiguwäi lidan ubóu?

Ka gi wagu?

Hutu saragu tidangie budunudagei lun gayarabei lan talugurahouniwa kenburi ge: üdüraü gürisi, ouserahamuti budunudagei lun hadügünei ken ekosistema, Furangugüda bai idan luban lan tasufurirunei ekonomia anhein hanchugua sungu bai budunudagei?

Uba ürüwa ehenpulu luáguti idan liña lan tichugu budunudagei ibagari baranaha.

Anheningua budunudagei, úabai agüdahani anhein ñibi hiriri luma amu luriban dan. Ida luba lañaurihan fulasu Lara duna luma Lara beya anhein magüdaha lani budunudagei?

Saragu chansi (Gayarati bounabu lougiñe aban weyasu kadan aban lidangie alügüdahani)

Anhein ñi luriban dan ken buri hiriri, garabali, kaban hamugagi añawurihawa anhein uwa budunudagei?

- a. Durunu laru beya
- b. Üdüraü hama animalu denchatiña baranaha
- c. Ouchahatiña hama asenichatiña
- d. Muna to yarafabou Lara beya o Laru duna

Kà ba gayaran làn lañawurihani habie bararugu *Lutjanus griseus*?

- a. Huwan dunuru beyabuna
- b. Hiriri luma amuñeiguenarügü luriban dan
- c. Tuwan luma tanchuahàuniwa budunudagei
- d. Tounigiruniwa budunudagei

Kà tadügübai budunudagei lau gasi tani atmósfera?

- a. Aban tagibedoguagüdü CO<sub>2</sub>
- b. Sagatu C tidangie Atmósfera
- c. Sagatu CO<sub>2</sub> tidangie Atmósfera
- d. Aban tagibedoguagüdü O<sub>2</sub>

## Critical Thinking Skills

If mangroves became extinct, would the global climate be affected positively or negatively? Why?

Many commercially important species, like the gray snapper (*Lutjanus griseus*), depend on the ecosystems created by the mangroves. Explain how the economy would suffer if the mangroves were reduced.

Give three examples of the mangroves as providers for the marine life.

Without mangroves, we lack protection from hurricanes and the problems caused by them, including erosion. How is the sea shore population's safety affected when we lose the protection from the mangroves?

**Multiple Choice** (some questions may have more than one answer)

1. Which of the following would be most affected by erosion in the mangrove areas?

- a. Wading birds
- b. Deep sea predators
- c. Local fishermen
- d. Nearby homes

2. What could cause a drastic decrease in the population of *Lutjanos griseus*?

- a. Lowering the population of the wading birds
- b. A hurricane
- c. The destruction of the mangroves
- d. The conservation of the mangroves

3. What do mangroves do to the gases in the atmosphere?

- a. Produce CO<sub>2</sub>
- b. Take C from the atmosphere
- c. Take O<sub>2</sub> from the atmosphere
- d. Produce O<sub>2</sub>

## Konektibidad luma Ambiente

Chubaluguni Bougudigieti:

*(Tun luban furendeï to yarafabou lun laru beya)*

**Tabunogu habiebararugu üdüraü tau budunudagei funatu**

Ubuñei:

- (Abu) tabu budunudagei. Gayaranti abudahàuwarügü làn labadünogua sun, irumu ken lagelewehan budunudagei uguchilin. Boundarame lumagie 3 lun 5 kadan aban hadangie aturiahatiña
- (Abu) tabu budunudagei. Gayatanti abudahàuwarügü làn labadünogua sun, irumu ken lagelewehan budunudagei uguchilin Boundarame lumagie 3 lun 5 kadan aban hadangie aturiahatiña
- 2 Budèin plàstiko tagei furesugu le malati 2 litüru (3 hàun 5 aturiahatiña.
- Tügürügü fáluma.
- Sustrato de tierra fangosa del manglar.
- 2 Budèin plàstiko tagei furesugu le malati 2 litüru (3 hàun 5 aturiahatiña.
- Tügürügü fáluma.
- Gubegubeti larigi tilagüle budunudagei.
- Bungidu.
- Isiresi.
- Duna.



Ligaburi ladügün wadagimanu: Anuadihaban aban fulasu tidan luban, furendei ñi lun bai anihein làn saragu lamuña. Aban me bibugu lamidan budèin plàstiko tau isiresi, aban me babadiru murusu mua charichariti tau tügürügü fàluma lau 2.1. murusu lasu aban me bafidiha aban, aban luèigie kadan aban aru, larigi, aban me bafeinduiruni lau ewegeruni gàfe luma funayumati, larigi aban, men babununi. lasu aban me babuinchagüdüni lamidan budèin lau baditi lira. Babürüdei me weyu le habunubali budèin lau sunsun liri aturiahati. Bafidirei me budein lidan lamuñounga larigi maküwali làn. Baturogueime lau duna bimeti sagü weyu labadünogua 4 o 5 hati lubaragie lanügü lun labununiwa lidon amu fulasu. Boundarame hama banigu aturiahatiña hama marufudahatiña lun bamuriaha idemu hama gumadimatiña hubiebararugu lun hideha arufudei fulasu le timan buidu bai lun tabunoguniwa budunudagei ñi, itara ge ken dan le buiduha bai, lun ladügü wadagimanu le.

*(Tun luban furendei to disebou luèi laru beya)*

### **Tadügü tubiebararugu nadü**

#### Ubuñei:

- Tugudina nadü to, bubiebararugubo (hamagie 3 hàun 5 kadan aban aturiahatiña).
- 2 Budein plàstiko le malati 2 litüru tagei furesugu (3 hàun 5 kadan aban aturiahatiña)
- Isirei lun bahàun fuluri lidan patiu
- Konpost (gayaranti ladügüniwa lau katei le igirogubai larigi amuñegueinarügü wadagimanu munada)
- Isiresi.
- Duna.

Ligaburi ladügü wadagimanu: Anuadihaba aban fulasu hamuñati tidan luban furendei le resibiti saragu weyu weyuogu. Aban me bibuguni übaü le iñugiebai luèi budèin plàstiko larigi ana me bagubudun 2:1. murusu mua lidan bungidu lau compost lau, larigi aban me babuinchagüdüni lamidan kadan aban lidangie budèin. Babürüdei me liweyuri labuichagüle kadan aban lidangie budein lau sun tiri tuwuyeri nadü lau ge kadan aban liri aturiahati. Bafidireime budèin lidan aban fulasu le maküwali. Baturogueime lau duna bimerti sagü weyu, arenselime plàntulasuban lasügüragüdüniwa lidon amu fulasu ken me inchali lau aban 45-50 cm. Aban me hamuriaha idemu luma aban arufudahati, tu lun lagoubadagu huma lun gayaran bai làn hamuriaha idemu hama gumadiwatiña baruwa lun harufuduni fulasu le buidubai lun tasügüragüdüniwa budunudagei ñi hàun, lau sun ge dan le buidubai lun tahüchü.

# Connectivity and the Environment

## **Outdoor Activity:**

*(For schools located close to the sea coast)*

### **Building a red mangrove nursery**

#### **Materials:**

- Mangrove propagules (seeds). These can be collected all year round from the parent mangrove tree. Collect 3 to 5 per student.
- Empty 2-liter soda plastic bottles (3 to 5 per student).
- Coconut coir or fiber.
- Muddy soil substrate from the mangrove forest.
- Bucket.
- Scissors.
- Water.



**Procedure:** Choose an area in your school with enough shade. Cut the top half of the plastic bottles with scissors. In a bucket, mix the muddy soil with the coconut coir in a ratio of 2:1. Fill half of each plastic bottle with the mixture. Place the red-brownish part of one propagule in the soil of each bottle. Label the bottles with date of sowing and student name. Place the bottles in the shaded area previously identified. Water the propagules daily with fresh or brackish water for a period of 4 to 5 months before outplanting. Together with your teacher, ask for collaboration with local authorities to identify the best places and times to plant the mangroves. On the day and place indicated, place the propagules in the substrate the same way you did in the plastic bottles, leaving a distance of approximately 35 cm apart from each other.

*(For schools located away from the sea coast)*

### **Building a nursery of native trees**

#### **Materials:**

- Native tree seedlings from your area (3 to 5 per student).
- Empty 2-liter soda plastic bottles (3 to 5 per student).
- Garden soil.
- Compost (can be made from organic leftovers at home).
- Scissors.
- Water.



**Procedure:** Choose an area in your school which receives sunlight for only a few hours each day. Cut the top half of the plastic bottles with scissors. In a bucket, mix the garden soil with the compost in a ratio of 2:1. Fill half of each plastic bottle with the mixture. Place one seedling in each bottle. Label the bottles with date of sowing, plant species, and student name. Place the bottles in the school area previously identified. Water the seedlings daily with fresh water. Seedling will be ready for out-planting when they grow to a size of approximately 45-50 cm. Together with your teacher, ask for collaboration from local authorities to identify the most best places and times to plant the tree.

## **Dimurei lun gufarandawa làn**

**Abanigibu** (Substrate) s. m. Ubuñei ligiboagu mua, uti ubaraü lun organismo lun labagaridu labu sun lun lahüchü áigini ñi.

**Asidifikasiön lani Oséano** (Ocean Acidification) s.f. Aban lañüraüdü ani duna pH lidan Óseano, ligía laweiridogu bai garühüti lidan duna lau abansun 30/ ladüga lañürogu dióxido lani gárubun lidan atmósfera (CO<sub>2</sub>).

**Arumugagülei** (Rookery) s. m. Fulasu le hu bai ken habiebararugu dunuru hama animalu atagüdatiña ani aban hadamuridagun baranaha lun hameilihan.

**Budunudagei** (Mangrove) s. m. Nadü lanina lubachouga, awandatumu lubasua ani labadünogua gubegubeti tachücha luru beya tahücha, anuhein tidangie arihäuwati tilagüle ladüga ligiboaguñei gubegubeti luma duna, idehatu lun meigahan làn laru duna beyabu labu sun lun buidu làn duna, idehatu ge lun agüriahäu üdüraü labadünogua tilagüle hama amuñegueinarügü.

**Dióksido lani Gàrubun** (Carbon Dioxide) s.m. Gasi le timan weiribai lidan gadabali sun ahüchüti lau, lagoubadagu luma atómo lani gárubun luma oxígeno. Aban lahüchü larigi lagoubadagu ubuñei la gaganabai garubun (agoubadagueina lau gasisun fósiles) lidan resigüda, lañaladun ubuñei orgàniko luma lawaragu organismo garabaliruguna.

**Dunuru beyabuna le chatiba li piku** (Short-billed Dowitcher) *Limnodromus griseus* Gmelin, 1789) s. m. Liraüraü dunuru beyabuna, sügülmuti luriban dan lidan gubegubeti muarugu o laru beya, le basuati. Dunuru Limikolas (Wading Birds) s.f. pl. Dunuru dunaruguna, hadangietiña haduheñu Charadriiformes, subudiwatiña ladüga migife làhapiku, hagudi luma hagína, subudiwatiña ge. Luagu ligürewài heibugu labadünogua duna lubu labadünogua gubegubeti.

**Ekosisütema** (Ecosystem) s. m. Aban sisütema weiriti acharoguwati lau organismo gabagariti lau sun katei abiótiko le geyegu bai lau.

**Erèi Gagiribudagüti** (Renewable Energy) s. f. lidangie katei magumuchoguati lahücha, abahüdeina weyu, garabali, lerouga, duna bachati, biosama. Subudiwati ge ken erèi harumati ladüga amuti ligaburi luèi erèi lela gaganathe bai gasi luma fósilü úati kontaminarülani ambiente. Anihein amu luwuyeri erèi le gagiribudagüti gagoubadaguti lingua luma weyu, erèi eólíka, hidroelèktrika, erèi geometrika luma biocombustible.

**Gadurunti** (Culprit) adj. / s.m. y f. Gürigia le responsableti luagu aban charati o turobuli.

**Gasi Fósilü** (Fossil Fuel) s. m. Gasi le lidangie bai lubuñe hidrokarbonos biológiko le acharoguwa bai lauciedad mua naturaliti. Anihein gàrubun, golu wuriti, sagoule luma alkitran lidan sun gasi fósilü. Saminawati ken ladüga làn yarafagua lun bai lasansirogu dan uboagu, ladüga yusuwati milu luagu miyun dromu dióksido lani gàrubun sagü irumu, (CO<sub>2</sub>).

**Habiebararugu üdüraü anagü** (Underwater Habitat) s.m. Fulasu labugiele duna, ñi lun bai haganowa amüñeguinarügü animalu hama üdüraü, abahüdüwati ge abiótikos lau sunsun biótikos lani ligaburi dan labugie duna.

**Hiriri** (Hurricane) s.m. aban luwuyeri luriban dan le ahüchü bai baranaha ani bidati ligarabalin aban oufuni lau 74 mph según hemisferio nurugie, garaboguati lawanseru ligarabali hiriri luwài lagusate aban relöh, anhein titi lidan hemisferio ünabugieti agararaharügüti lau ligarabogua lasugate relöh.

**Inbertebrados** (Invertebrates) s. m. /adj. Subudiwati animalu le lau mabu lán lanaga lau sun ge ligaburigu tacharogu lisélula, Chagua tiña inbertebrados saragu número ani añahein 97 san luagu san hadangie lau sun ge daruguatiña lau saragu filu, abahüdeina Polifera (mudusi)), Cnidaria (kurali, garugaru, anémonas), Platyhelminthes (gusanos planos), Nematodo (heweraü gararatiña), Annelida (heweraü fareintiña ken bararidiga), Moluska (wadabu, hama arara), Arthropoda (harahüñü animalu, anasi, hürü), Echinodermata (waruguma baranahana, pepino baranahana).

**Lasansirogu dan** (Climate Change) s. m. Ligaburi li lü lasansirogu dan luagu, ladüga amüñeguinarügü hawadigimari wügüriña lasüdü ubou., ladüga laweiridun CO<sub>2</sub> tani atmósfera larigi layusuruniwa saragu gasi fósilesü. Gayaranti lasansirogu dan, larigi lagibedogu larouga lidan ubou. Según Fondo Mundial tun Naturaleza (WWF), Laweiriduña sun fenómenos meteorológicos lidan sun ubóu, Ligía adügübai lun lawàinamudun ligaburigu lugudi luma lasansihan barana.

**Lagubudogu** (Collapse) s. m. leiguadu o lagumuchogu sisütema, lacharogu, bisinisi, adamuridoguni o furumieguarügü katei.

**Leigahan o, lagumuchogun** (Erosion) s. f. Lagumuchogun lubuñe mua ladüga garabali, glasialü luma duna, ehènpulu, huya, gahügüau, duna bimetiand, aroyos, ebêni, lugudi baranaand luma fuludu. Aban lagoubadagun leigahan dübü luma amu ubuñei lidangie aban fulasu.

**Marehada lani Luriba dan** (Storm Surge) s.f. pl. Liñuru lugudi barana, le adügübai lun lagoubadagu fuludu luma hiriri luma lère garabali.

**Moluskus** (Moluskus) s. m. /adj Invertebrados, gaduheñuguaña hama filo Moluska (lidangie latín Moluskus, “ñuluti, huáliti”, subudiwati ladüga mafareinragu lán lugubu, daruguti lau hugubu hibagei animalu tau aban tagei karbonato lani kalsiu. Gabulugutiña sungu bai moluskus tuma aban masa ñi lun bai hanigi luma organu lun hawaragu, hagibedogu luma lun hamuru, labu aban ugudi lun heibugu luma lun heibagu. Gantiñage aban sisütema lani nerbiu, aban seloma timantimanti, kaisigirügü aban lubara aban ugubu buiñu lau duna labu sun aban übaü le adaurogubai lau habu, hadan hibagei hadangie animalu han wiyuguati hagei murusu duna lun tatunou nadü to adaurogubali hagubu. Moluskus ligía libiaman bai lidan haruwáihan animalu ha timan gibebaña arigí Arthoropoda, gadan hamali lougie 100,000 hawuyerigu ha iriduwabaña, abahüdeina gasterópodos (wadabu, gabanwatiña). Cefalópodos (kalamarü, Arara, nautilus), Bibalbos (suwindiri, harahüñü wadabu, Ubuyubu-agei-). Subudiwatiña cefalópodos kaisi invertebrados ha kubana au ani aban ehénpulu lun labihin li chu au luma gufarandaü hadan animalu.

## Glossary

**Carbon Dioxide, CO<sub>2</sub>** (Dióksido lani Gàrubun) n. A gas that is denser than air and is formed by the combination of one carbon atom and two oxygen atoms. It is produced in combustion of materials containing carbon (including fossil fuels), in fermentation, decay of organic materials, and in respiration of aerobic organisms. CO<sub>2</sub> is absorbed from the air by plants in photosynthesis, while oxygen is produced as a by-product. CO<sub>2</sub> is one of the main causes of the greenhouse effect. It also causes ocean acidification as it forms carbonic acid when it dissolves in water.

**Climate Change** (Lasansirogu dan) n. A periodic change in the Earth’s climate system over a long period of time. The most recent change is caused by human activities such as burning fossil fuels that lead to global warming due to increasing levels of atmospheric CO<sub>2</sub>. An increase of 2°C in global average temperatures may lead to catastrophic climate change. According to World Wildlife Fund (WWF), increasing temperatures are causing the frequency and intensity of severe weather events around the world, resulting in melting glaciers, rising sea levels, and new weather patterns.

**Collapse** (Lagubudogu) v. n. A severe failure or breakdown, or complete destruction of a system, structure, business, institution, or something else.

**Culprit** (Gadurunti) n. Someone who is responsible for a problem or for committing a fault, or that is accused of a crime.

**Ecosystem** (Ekosisütema) n. A complex system of living organisms, their abiotic and biotic environment, and all their relationships and interactions in a particular unit of space.

**Erosion** (Leigahan o, lagumuchogun) n. The gradual wearing down of material from the Earth’s surface caused by wind, glacial processes, and water, e.g., rainfall, runoff, rivers, streams, currents, waves, and floods. Erosion includes the weathering of rock or other material in one location and their transport to another point.

**Fossil Fuel** (Gasi Fósilü) n. Fuel derived from hydrocarbon materials of biological origin formed in the Earth by natural processes. Fossil fuels include coal, petroleum, natural gas, tar sands, and heavy crude oil. They are considered the biggest driver of climate change as their burning produces several billion tons of carbon dioxide (CO<sub>2</sub>) per year.

**Hurricane** (Hiriri) n. Type of storm called a tropical cyclone that originates over warm tropical or subtropical waters and which has winds that reach a speed of 74 mph. In the northern hemisphere winds rotate counterclockwise, while in the southern hemisphere the rotation is clockwise.

**Invertebrates** (Inbertebrados) n. /adj. A multicellular animal without a vertebral column or backbone. Invertebrates form the most numerous group of animals, as they contain approximately 97 percent of all animal species and include many phyla, including *Porifera* (sponges), *Cnidaria* (coral, jellyfish, anemones), *Platyhelminthes* (flatworms), *Nematoda* (roundworms), *Annelida* (segmented worms such as earthworms), *Mollusca* (snails, squid, octopus), *Arthropoda* (insects, spiders, crabs), *Echinodermata* (starfish, sea cucumbers).

**Mangrove** (Budunudagei) n. A tropical or subtropical salt-tolerant tree or shrub that grows in the coastal intertidal zone along estuaries, in salt marshes, and on muddy grounds. These areas are characterized by having saline water, daily tides, anaerobic soil, and intense sunlight. To survive under these conditions, mangroves have developed several adaptations, such as leaves that excrete salt, vivipary which means that seed germination begins while still being attached to the parent tree, and their characteristic aerial root systems. Many species have roots that are exposed over the water to provide structural support in the soft sediment, exclude salt, and absorb oxygen from the air through specialized respiratory root structures called pneumatophores. These contain breathing pores or lenticels. Mangroves provide diverse ecosystem services. Among others, they protect shorelines from hurricanes and erosion, serve as sediment traps, improve water quality, and serve as nursery areas for reef fish, invertebrates, and other species.

The term mangrove also applies to forests or vegetation of such plants.

**Mollusks** (Moluskus) n. Invertebrates belonging to the large and diverse phylum *Mollusca* (from the Latin *molluscus*, "soft") characterized by having a soft unsegmented body which in most species is completely or partly covered by a calcium carbonate shell. All mollusks have a head; a visceral mass containing the heart and organs of respiration, reproduction, digestion, and excretion; and a muscular foot used for locomotion. They also have a nervous system, a true coelom, i.e. a body cavity filled with fluids, and a mantle or dorsal body wall covering the visceral mass. In most species, the calcareous shell is secreted by the mantle. With more than 100,000 described species *Mollusca* is the second most diverse animal phylum after *Arthropoda*. Mollusks include gastropods (snails, slugs, conch), cephalopods (squid, octopus, nautilus), bivalves (clams, oysters, scallops, mussels), and a few obscure groups. Cephalopods are considered to be the most intelligent invertebrates and an example of how the process of acquiring knowledge and understanding has evolved in animals.

**Ocean Acidification** (Asidifikación lani Oséano) n. A decrease of the pH of ocean water that represents an increase in water acidity of approximately 30 percent, resulting from an increased concentration of carbon dioxide (CO<sub>2</sub>) in the ocean.

**Renewable Energy** (Erèi Gagiribudagüti) n. Energy that is obtained from renewable sources, including the sun, wind, tides, rivers, hot springs, biomass, among others. It is also known as clean energy because unlike energy derived from burning of fossil fuels, it does not produce environmental pollution. Some types of renewable energy include solar energy, wind energy, hydroelectric power, and geothermal energy.

**Rookery** (Arumugagülei) n. The breeding ground of some birds and marine mammals that nest in colonies or congregate to breed.

**Short-billed Dowitcher** (Dunuru beyabuna le chatiba li piku) (*Limnodromus griseus* Gmelin, 1789) n. A medium to large, long-billed, migratory shorebird that spends the winter on coastal mud flats and brackish lagoons.

**Storm Surge** (Marehada lani Luriba dan) n. An elevation of sea level that produces a coastal flood and is caused by the strong surface winds and low atmospheric pressures associated with tropical cyclones.

**Substrate** (Sustrato) n. A surface or underlying material that provides an organism with a place to live, grow, or obtain food.

**Underwater Habitat** (Habiebararugu üdüraü anagü) n. The place or environment under the water surface where a species, species populations, or one or several communities live. These habitats include the abiotic and biotic components of the surrounding underwater environment.

**Wading Birds** (Dunuru Limíkolás) n. Aquatic birds, especially those belonging to the Order *Charadriiformes*, which are characterized by having long legs, necks, and bills which help with, wading or walking through water or mud in search for food.



Abürürüti Elmer Mauricio Enríquez hama idudunu tabul Garüdia Garifuna hama aturiahatiña Garinagu tidan Luban Furendei háun wügüríña Justo Rufino Barrios, Labuga.

Ethnotranslator Elmer Mauricio Enríquez with Garifuna and Kethcl Maya students with Garifuna educational materilas at Escuela para Varones Justo Rufino Barrios, Livingston, Izabal, Guatemala.



Lariufuduñein akutihati número aban Robby Thigpen, lakutiha habügüri harahüñü ouchahatiña laru baran Oksidental lidan aban adamuridaguni hama arufudahatiña aüdü Asibañulu Lookout Cayu, Balisi, Lamidan Meriga. Iyawaü: Celeste Castillo tabu Alyssa Majil.

Principal Investigator Robby Thigpen presenting his research on the artisanal fisheries of the western Caribbean at a teacher's workshop on Spanish Lookout Caye in Belize, Central America. Photo by Celeste Castillo and Alyssa Majil.



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