

# Fishery Ecosystem Plan

## Stakeholder Engagement Workshops

Project Report

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## Background

Ecosystem-based fisheries management (EBFM) is defined by NOAA Fisheries as “a systematic approach to fisheries management in a geographically specified area that contributes to the resilience and sustainability of the ecosystem; recognizes the physical, biological, economic, and social interactions among the affected fishery-related components of the ecosystem, including humans; and seeks to optimize benefits among a diverse set of societal goals.” The Caribbean Fishery Management Council (CFMC or Council) initiated the development of a Fishery Ecosystem Plan (FEP) in early 2019 to support its transition from a species-specific management framework to an island-specific approach through its recently approved Island-Based Fishery Management Plans (IBFMPs). Consistent with best practices for development of an FEP, the CFMC’s three District Advisory Panels (DAPs) developed island-specific conceptual models to identify important ecosystem components and relationships for each of the Council’s districts (Puerto Rico, St. Thomas/St. John, St. Croix) during 2019 and 2020. Concurrently, the Council’s Scientific and Statistical Committee (SSC) developed a system-wide conceptual model with different sub-models for major groups of ecosystem components (e.g., socio-economic, water quality, abiotic factors, etc.).

Recognizing that extensive stakeholder involvement is the foundation of a successful FEP, the CFMC worked with the chair of its Outreach and Education Advisory Panel and staff from The Pew Charitable Trusts (PCT) to identify additional stakeholder groups for targeted engagement efforts. The perspectives of these stakeholders, who may not typically be involved in the Council’s work, can reveal information about the relationships among ecosystem components that are not readily apparent to fisheries managers or scientists. As one component of a larger, coordinated approach to reach multiple stakeholder groups, the PCT offered to support a series of virtual stakeholder engagement workshops for coastal businesses and local environmental nongovernmental organizations (NGOs) via an external consultant (Mellivora Consulting). The purpose of the workshops was the development of conceptual models for the fishery ecosystems of the Council’s three island districts by each stakeholder group (six models total). The stakeholder models will be provided to the CFMC for consideration as part of the Council’s melded conceptual model that includes those developed by the Council’s SSC and DAPs. This report describes the organization, execution, and results of these outreach efforts to ensure that a variety of stakeholder viewpoints are incorporated into the development of the CFMC’s FEP.

## Methods

### Stakeholder Contacts

As noted above, two stakeholder groups were the focus of this project: coastal businesses and local environmental nongovernmental organizations. A broad approach was taken regarding identification of stakeholders within each category. Coastal businesses included dive shops, surf shops, outdoor adventure guides/outfitters, restaurants, sailing charters, hotels/motels, and guest houses. Environmental NGOs included local entities focused on water quality, sustainable coastal development, marine debris, environmental education, sustainable agriculture, habitat protection, living marine resource management/monitoring, among others. An extensive contact list for both stakeholder groups

was developed in coordination with the CFMC's Outreach and Education Advisory Panel Chair and Sea Grant staff, consisting of 80 environmental NGOs and almost 200 coastal businesses across all three CFMC districts.

A total of six virtual workshops were conducted, one for each stakeholder group in each CFMC island district. Initial invitations were sent via email approximately four weeks in advance of each workshop, with follow-up phone calls to non-respondents seven to ten days afterwards. Based on the number of confirmations received, additional workshop invitations occurred through a combination of email and phone. Confirmed participants received an agenda and outreach materials (see below) by email. Workshop reminders with the agenda and outreach materials were also emailed to all participants two days in advance. Stakeholders in Puerto Rico received emails and materials in both Spanish and English. Finally, each participant also received a phone call either one day prior to or on the day of the workshop to confirm attendance.

Due to the virtual nature of the workshops, a target size of 8-12 stakeholders was identified to allow for participation by all attendees and for a thorough discussion of ideas. For each workshop, every effort was made to ensure adequate geographic representation and to appropriately reflect the diversity of entities within each stakeholder group. Ultimately, a total of 42 environmental nongovernmental organizations and 87 coastal businesses received invitations to participate in the workshops.

## Outreach Materials

Two information briefs were developed in English and Spanish to provide background and assist stakeholders in understanding the purpose of the workshops. The first, "Fishery Ecosystem Plans," defines commonly used terms (e.g., ecosystem, fishery, etc.) and explains how an FEP serves as a roadmap for a comprehensive management approach that incorporates social, economic, and ecological goals. It also describes how the CFMC FEP is integrated with the Council's IBFMPs and emphasizes the importance of stakeholders in determining FEP goals.

The second information brief, "Conceptual Models," describes how models are developed by first identifying ecosystem components (i.e., things that increase or decrease in either quantity or quality) and then determining the relationships, or linkages, among components. It includes a terrestrial example of a forest ecosystem conceptual model to illustrate these concepts. The brief highlights the use of conceptual models as tools to capture group knowledge about complex systems and to identify factors that may impact model components. It also stresses the importance of capturing different stakeholder viewpoints to appropriately characterize tradeoffs across different management goals. Copies of the briefs can be found in Appendix 1.

## Workshops

### Format

All six stakeholder engagement workshops were two hours in length and conducted virtually via Zoom due to the global Covid-19 pandemic. Workshops for coastal businesses were held during evening hours to maximize participation. For stakeholders in Puerto Rico, simultaneous translation was incorporated into the virtual platform. Workshops were recorded for verification of results, and stakeholders had the

opportunity to opt out of participation if desired. PCT staff members provided logistical support by taking written notes as a backup to workshop recordings, and operating the Mental Modeler online software used to develop conceptual models. The CMFC used Mental Modeler as a tool to develop the SSC and DAP conceptual models, and therefore it was used in these workshops for consistency.

All workshops began with a welcome and brief description of the project purpose, a webinar technology overview, and participant introductions. This was followed by a short presentation to review information from the Fishery Ecosystem Plan and Conceptual Model outreach briefs (Appendix 2). The forest ecosystem example included in the outreach materials was used to describe the elements of a conceptual model and to orient participants with model development.

The meeting format and methods were reviewed with Lenfest Ocean Program grantees conducting similar workshops with other stakeholder groups. The goal was to maintain a consistent approach across workshops, minimize bias, and facilitate potential incorporation of all stakeholder conceptual models into the Council's melded conceptual model.

### **Conceptual Model Development**

Stakeholders engaged in three minutes of individual brainstorming to identify three to five social, ecological, economic, or cultural components of the marine fishery ecosystem in their district. A slide with trigger questions and a schematic remained on-screen during the brainstorming session to remind participants of the definitions of components and linkages. Afterwards, stakeholders were each guided through describing their components, which were captured onscreen using the Mental Modeler software. Once all stakeholders had identified their components, facilitated discussion continued while participants exchanged viewpoints and determined if additional components were needed to effectively describe the marine fishery ecosystem.

After component identification was complete, a 10-minute break was provided prior to a second brainstorming session to identify linkages among the components. Like the previous session, stakeholders were asked to spend three minutes identifying three linkages among the components. Because it can be challenging for participants to identify if a linkage is positive (an increase [or decrease] in one component results in an increase [or decrease] in another component) or negative (an increase in one component leads to a decrease in another component or vice versa), a single linkage between two of the onscreen components was used as an illustration. This example was based on stakeholder comments during component identification that alluded to the direction and nature of the linkage. A slide with trigger questions and the same schematic used for the previous session was displayed during brainstorming. After each stakeholder described his or her linkages, facilitated discussion occurred to identify remaining linkages and ensure consensus.

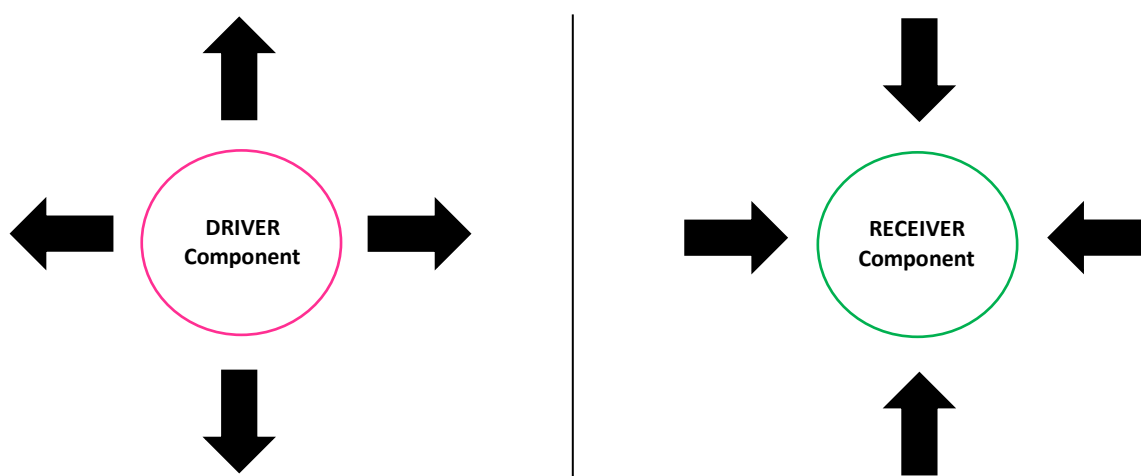
After model development was complete, next steps in the process were explained, including model review and validation (see next section) and presentation of results to the CFMC. Stakeholders were provided the opportunity to ask questions prior to adjourning the workshop.

## Post-Workshop

After each workshop, attendees received an email (in Spanish and English for Puerto Rico workshop attendees) that thanked them for their participation and contained a link to a Google document with the completed model from the workshop. Participants were provided two weeks to review the model and recommend any additional linkages among components. This allowed stakeholders an opportunity to validate the model they had collaboratively constructed. Only three participants across all workshops made additional suggestions. Workshop recordings were also reviewed to ensure all model components and linkages were accurately captured according to stakeholder input.

## Results

All six models were analyzed using the Mental Modeler software to determine which components were “drivers” within the model and which were “receivers”. “Driver” components were defined as *those that affected* the most other components, i.e., those with the most linkages directed from them towards other components. “Receiver” components were *those that were affected by* the most other components, i.e., those with the most linkages connecting to them from other components. Depending on the total number of linkages to and from a component, it could be both a driver and a receiver (Figure 1). It should be noted that the above definitions differ from how Mental Modeler classifies driver and receiver components. In Mental Modeler, driver components are those that *only* have linkages directed towards other components, whether that is one linkage or many; there are no linkages to drivers from other components. Conversely, Mental Modeler receiver components are those that *only* have linkages connecting to them from other components (whether one or many); there are no linkages from receivers to other components. The modified terminology presented here allows for driver and receiver components to have linkages in both directions, is more intuitive for stakeholders, and better reflects how they perceive the influence of components within the model. However, the modified terminology is only being used in this specific context for this project.



**Figure 1.** Illustration of driver and receiver components. Black arrows represent linkages.

## St. Croix Environmental NGO Community

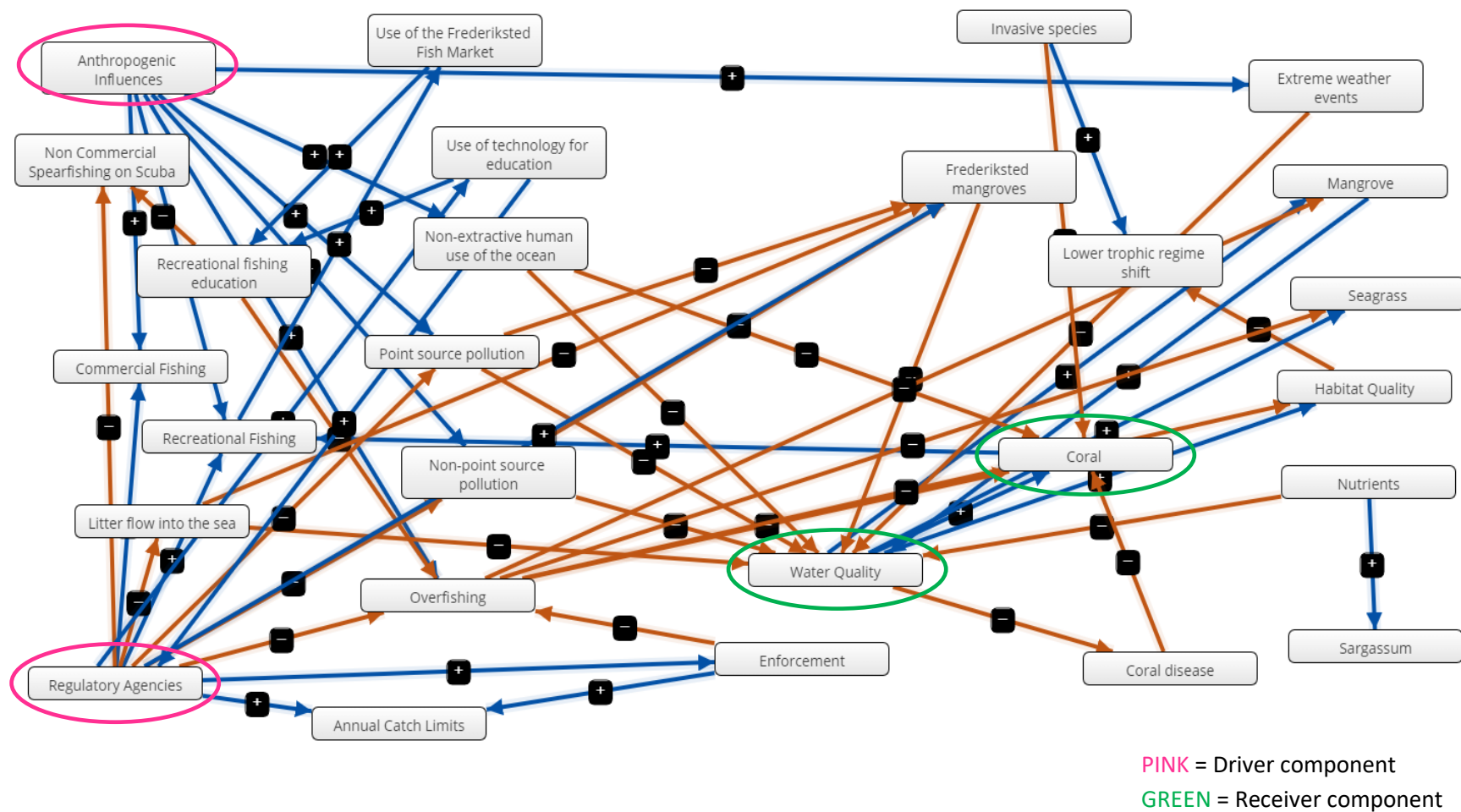
The stakeholder workshop for the St. Croix environmental NGO community was held on April 22, 2021. The conceptual model developed by participants has 27 components and 53 linkages (Figure 2). Identified components range from very broad (Habitat Quality) to very specific (use of the Fredriksted Fish Market). Stakeholders discussed issues that were very localized to certain geographic areas of the island, such as the loss of mangroves and polluted runoff around Fredriksted in particular. They also noted the impacts of various forms of pollution.

The two major driver components are “Regulatory Agencies” (11 linkages to other components) and “Anthropogenic Influences” (7 linkages to other components), with the latter also being a driver according to the Mental Modeler definition (i.e., no linkages are drawn to it from other components). The top two receiver components are “Water Quality” (8 linkages from other components) and “Coral” (5 linkages from other components), while the two components with the highest numbers of total linkages to and from other components are “Regulatory Agencies” (13 linkages) and “Water Quality” (12 linkages).

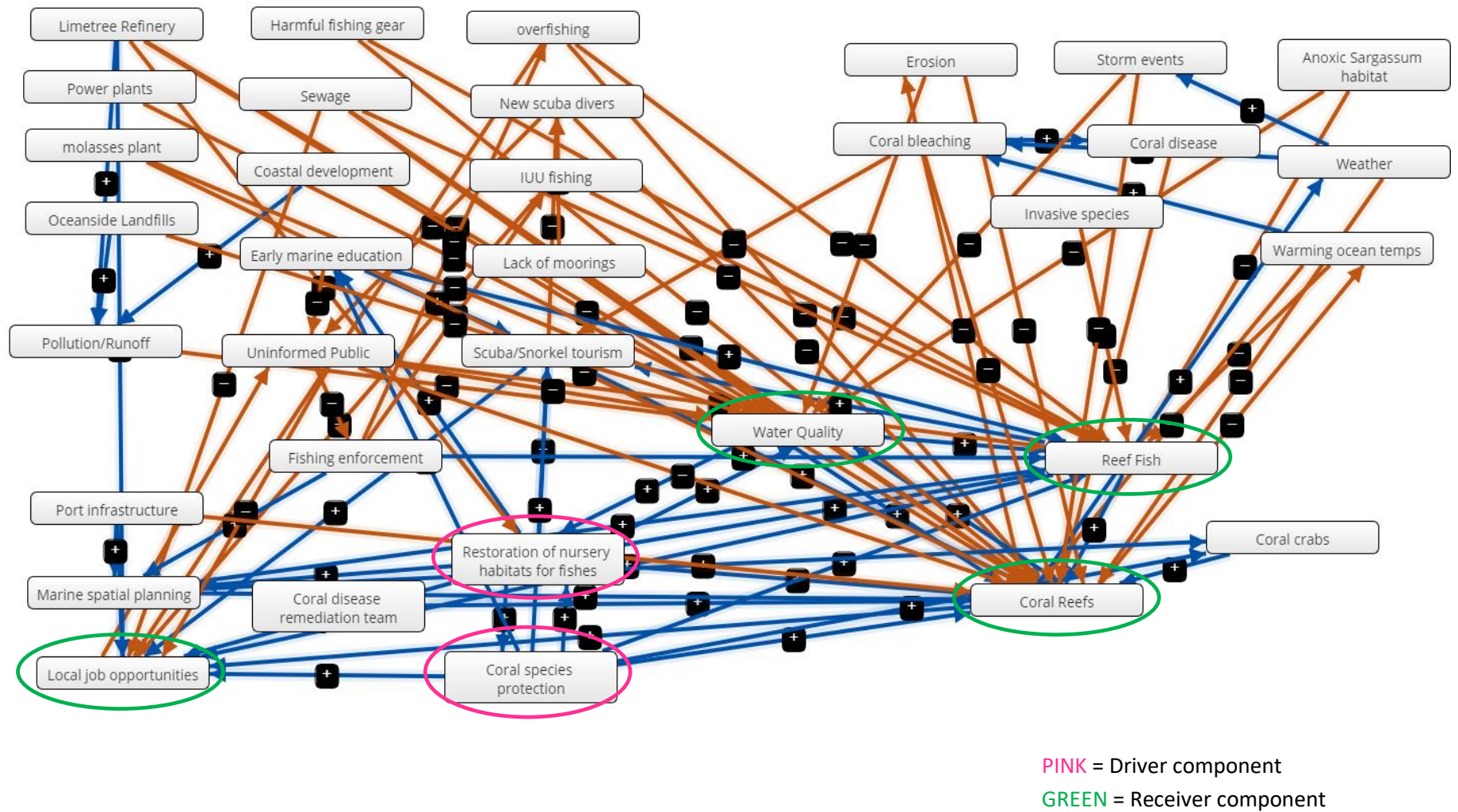
## St. Croix Coastal Business Community

The St. Croix coastal business community stakeholder workshop was held on April 27, 2021. The resulting conceptual model has 34 components and 94 linkages (Figure 3). Participants discussed the impacts of many different types of activities, including tourism and industrial activities, on water quality. Similar to the St. Croix environmental NGO community, participants noted the impacts of very specific entities (e.g., Limetree Refinery, Molasses Plant) on the ecosystem. However, they also acknowledged the economic benefits of these industries in the form of employment opportunities. Additionally, attendees discussed the need for and the impacts from a lack of education regarding the marine environment.

The major driver components are “Restoration of nursery habitats for fishes” (8 linkages to other components) and “Coral species protection” (6 linkages to other components). The primary receiver components are “Coral reefs” (22 linkages from other components), “Reef Fish” (14 linkages from other components), and “Water Quality” (12 linkages from other components), closely followed by “Local Job Opportunities” (11 linkages from other components). The components with the highest overall numbers of linkages to and from other components are “Coral Reefs” (28 linkages) and “Reef Fish” (17 linkages).



**Figure 2.** St. Croix Environmental NGO Community Conceptual Model. Pink circles identify driver components, while green circles identify receiver components.



**Figure 3.** St. Croix Coastal Business Community Conceptual Model. Pink circles identify driver components, while green circles identify receiver components.

## St. Thomas/St. John Environmental NGO Community

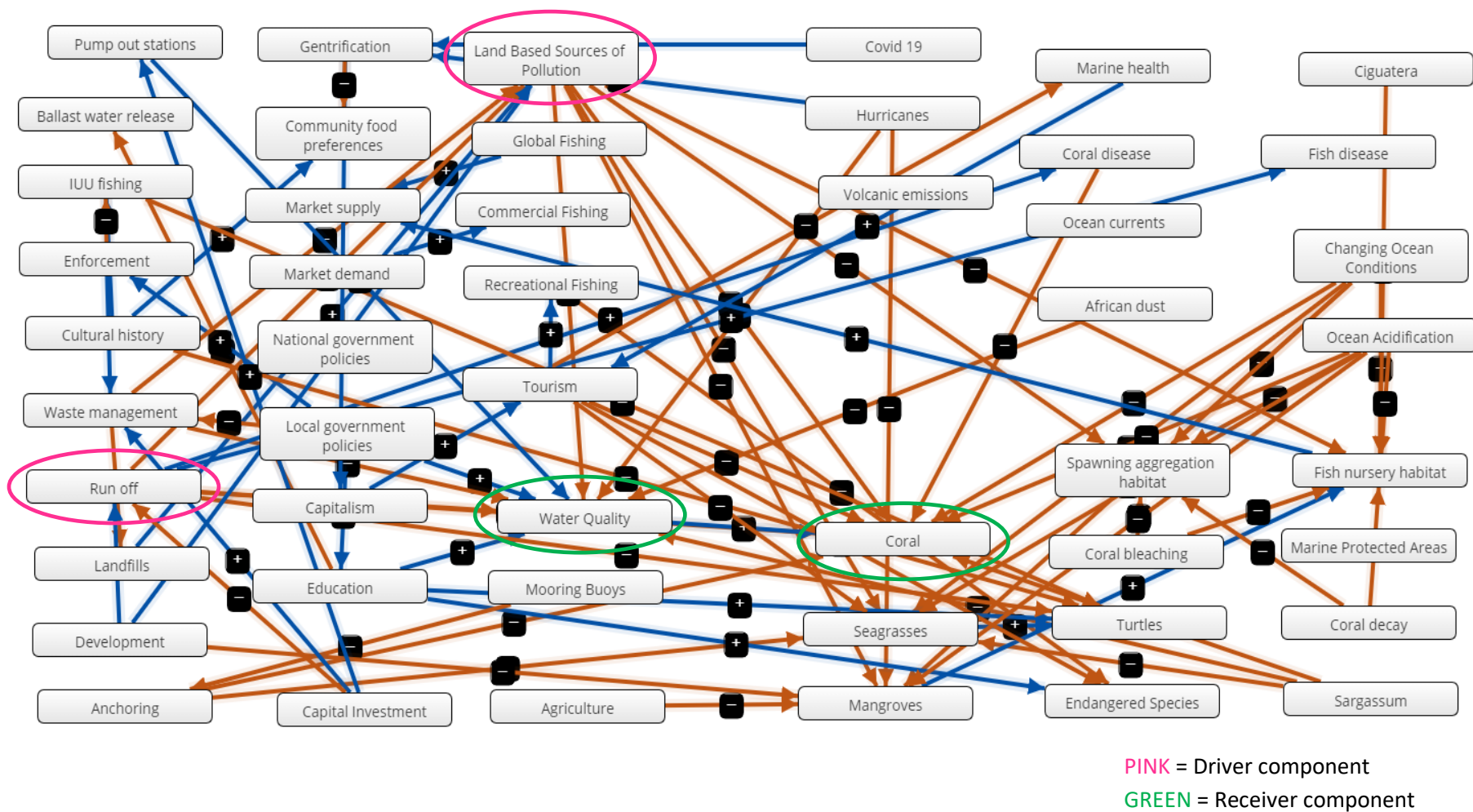
The stakeholder workshop for the St. Thomas/St. John environmental NGO community was conducted on May 10, 2021. The conceptual model developed by participants has 49 components and 81 connections (Figure 4). Stakeholders discussed issues such as the cultural history and heritage of islanders, as well as the impacts of capitalism and gentrification. They also noted the effects of certain activities on sea turtles and the connections between development, pollution, and water quality. The impacts of government policies and education on the ecosystem were also discussed.

The two major driver components in the model are “Land-based sources of pollution” (6 linkages to other components) and “Runoff” (6 linkages to other components), while the top two receiver components are “Water quality” (9 linkages from other components) and “Coral” (9 linkages from other components), with the latter also being a receiver component as defined by Mental Modeler. Overall, the components with the greatest number of total linkages to and from other components are “Water Quality” (10 linkages) and “Land-based sources of pollution” (10 linkages).

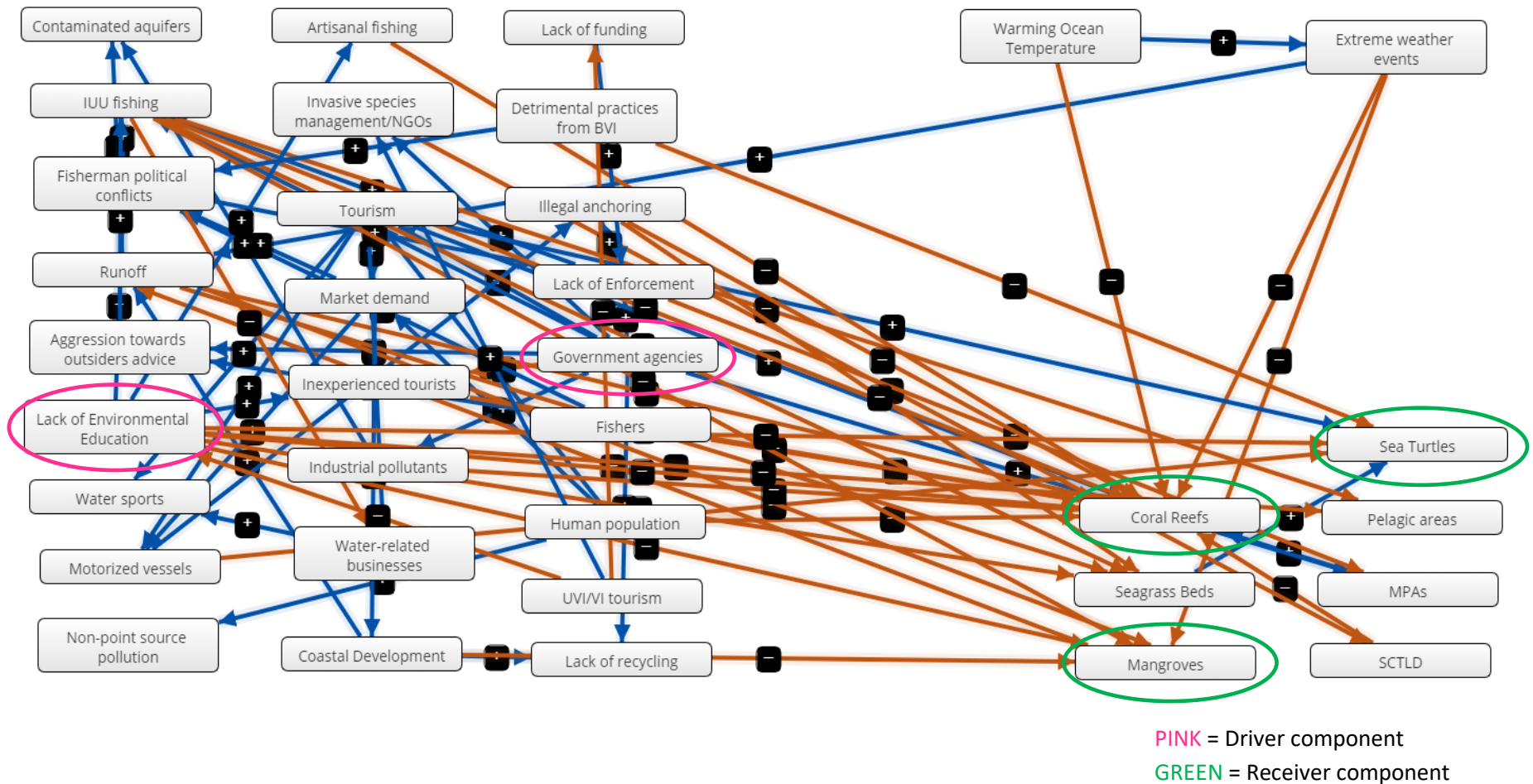
## St. Thomas/St. John Coastal Business Community

The St. Thomas/St. John coastal business community stakeholder workshop occurred on May 6, 2021. Participants developed a conceptual model that has 35 components and 76 connections (Figure 5). Like the St. Thomas/St. John environmental NGO community, attendees noted the impacts of multiple activities on sea turtles. They discussed at length the impacts of ineffective government, and the influence of politics and political conflict on several ecosystem components. Participants noted that environmental education was fundamental to addressing many issues and observed that advice from “outsiders” was not always welcome.

The primary driver components of the model are “Government agencies” (9 linkages to other components) and “Lack of environmental education” (8 linkages to other components), with the former also being a driver component as classified by Mental Modeler. The major receiver component by far is “Coral reefs” (14 linkages from other components), followed by “Sea turtles” (5 linkages from other components; also a Mental Modeler receiver) and “Mangroves” (5 linkages from other components). The two components with the greatest numbers of total linkages to and from other components are “Coral Reefs” (14 linkages) followed by a three-way tie among “Lack of environmental education”, “IUU (Illegal, Unregulated, or Unmanaged) fishing” and “Government agencies”, each with 9 total linkages.



**Figure 4.** St. Thomas/St. John Environmental NGO Community Conceptual Model. Pink circles identify driver components, while green circles identify receiver components.



**Figure 5.** St. Thomas/St. John Coastal Business Community Conceptual Model. Pink circles identify driver components, while green circles identify receiver components.

## Puerto Rico Environmental NGO Community

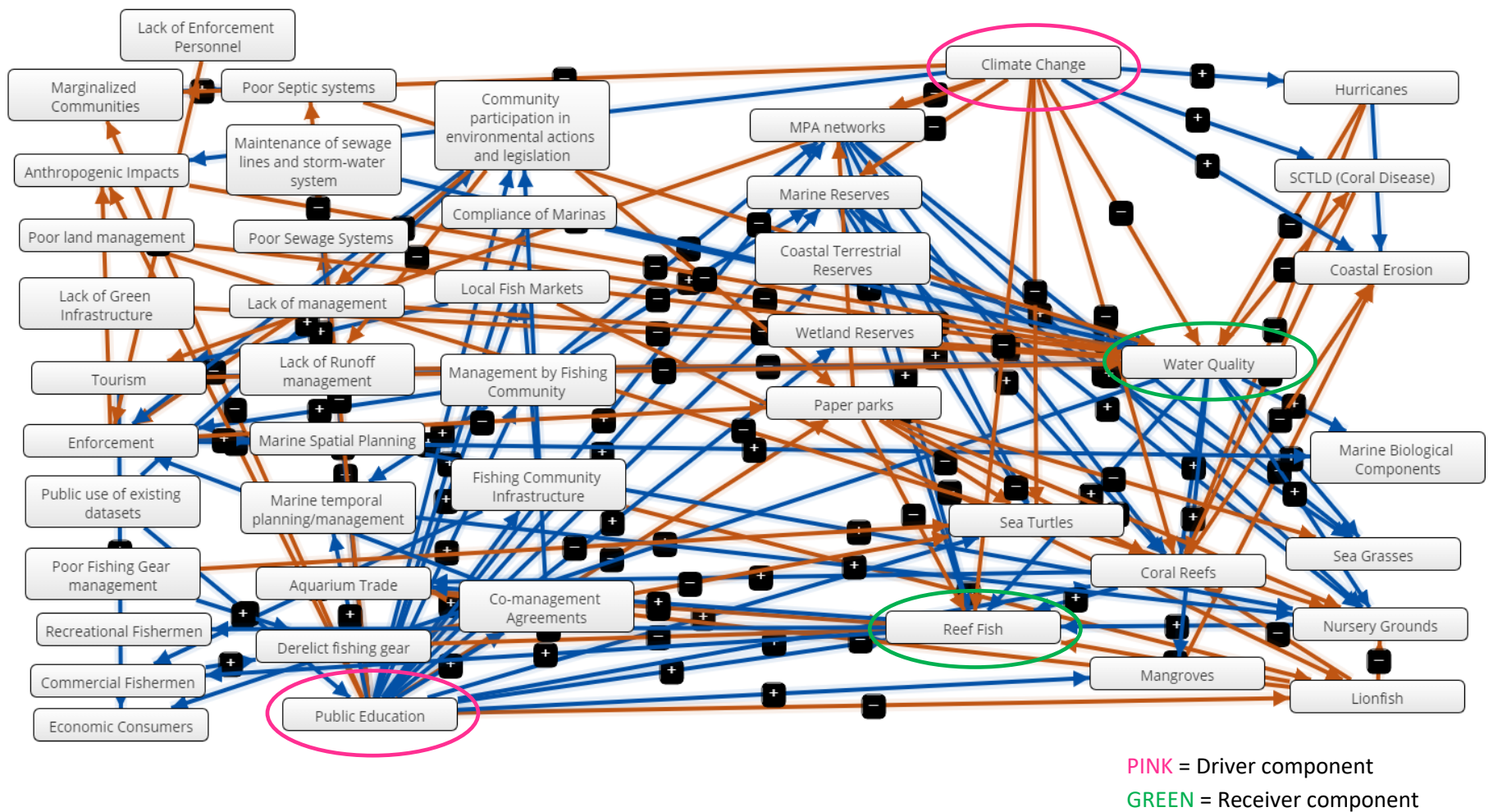
The workshop for stakeholders in the Puerto Rico environmental NGO community was conducted on May 27, 2021. Attendees developed a conceptual model with 46 components and 121 linkages (Figure 6). Many of the same discussion themes emerged as in previous workshops, e.g., pollution, development, water quality, education, etc. However, participants also noted the importance of community participation in environmental actions and legislation, and the use of publicly available data to facilitate that involvement. Attendees also discussed the use of both marine and terrestrial reserves as conservation tools, and the importance of both marine spatial planning as well as temporal planning. Several sources of pollution were identified, and the negative impacts of lack of management in general were highlighted.

“Public education” is by far the top driver component (22 linkages to other components) in this model, followed by “Climate change” (12 linkages to other components), with the latter also being a driver as classified by Mental Modeler. The major receivers in the model are “Water quality” (13 linkages from other components) and “Reef fish” (11 linkages from other components). Overall, the two components with the greatest total numbers of linkages are “Public education” (23 linkages) and “Water quality” (22 linkages).

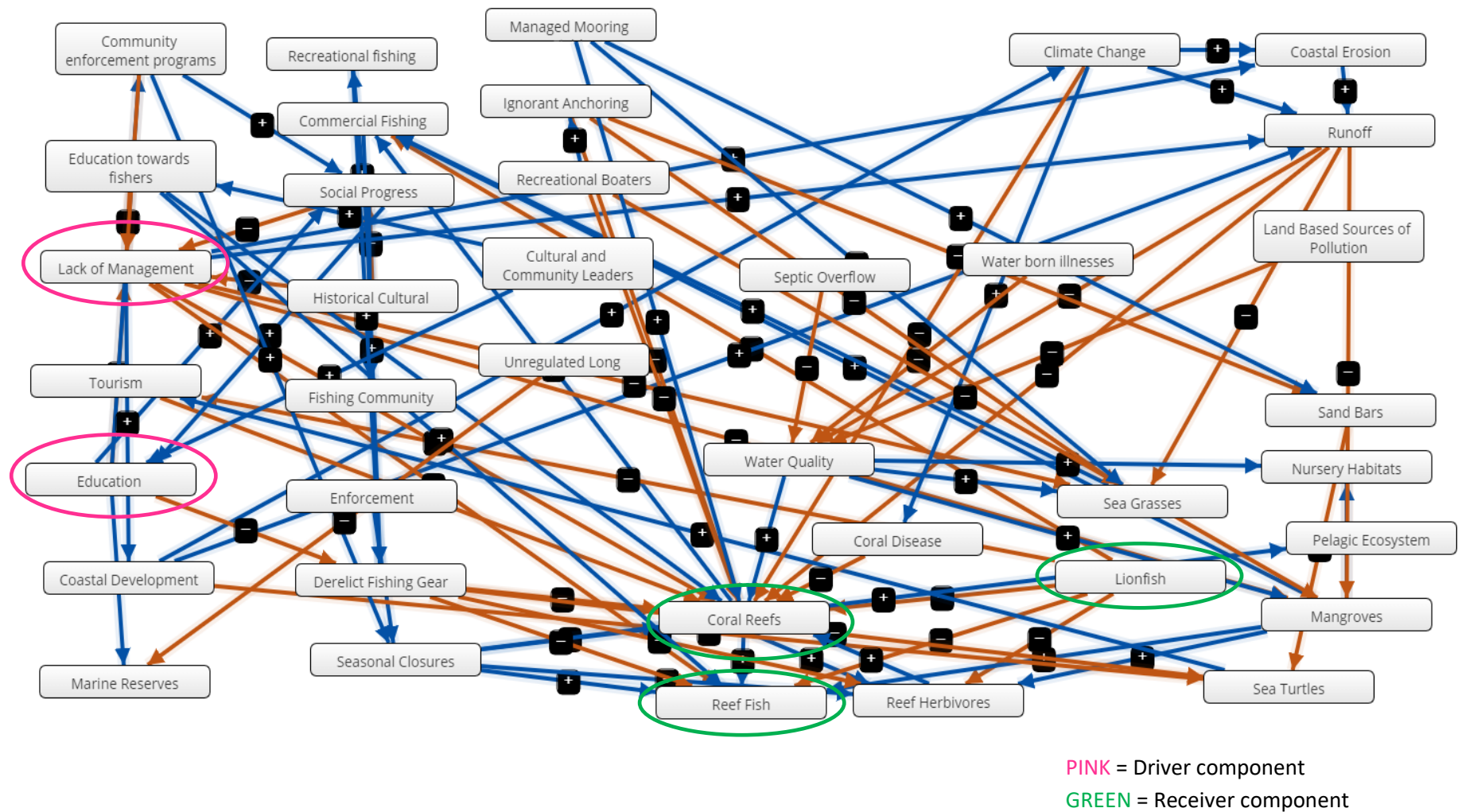
## Puerto Rico Coastal Business Community

The Puerto Rico coastal business community workshop occurred on May 25, 2021. Participants developed a conceptual model with 38 components and 84 connections (Figure 7). Similar to other workshops, stakeholders discussed issues related to water quality, various pollution sources, and education. Attendees also noted the heavy influence of historical cultural norms and the significant role of community leaders, and community involvement, in affecting positive change. Participants acknowledged their observations of negative impacts from coastal development, as well as fishing and recreational activities, and noted that lack of management played a role in these impacts.

The major driver components in this model are “Lack of Management” (7 linkages to other components) followed by “Education” and “Lionfish” (each with 5 linkages to other components). The primary receivers are “Coral Reefs” (14 linkages from other components) followed by “Reef fish” (7 linkages from other components), while the two components with the highest total numbers of linkages are “Coral reefs” (17 linkages) and “Lack of management” (12 linkages).



**Figure 6.** Puerto Rico Environmental NGO Community Conceptual Model. Pink circles identify driver components, while green circles identify receiver components.



**Figure 7.** Puerto Rico Coastal Business Community Conceptual Model. Pink circles identify driver components, while green circles identify receiver components.

## Common Themes

Some common themes and components are evident from the workshop summaries and conceptual models. For example, education emerged as a component common to all conceptual models and was a significant topic of conversation at several workshops, as were various forms of pollution and/or waste management. A complete list of components (or component types) common across all models includes the following:

- Education
- Enforcement
- Fishing activities and/or gear
- Pollution and waste management (e.g., runoff, erosion, point source/non-point source pollution, litter flows, sewage maintenance, etc.)
- Ocean, climate, and/or weather conditions
- Marine habitats (various types)

Additionally, tourism is a component identified in all conceptual models except that developed by the St. Croix environmental NGO community, while water quality is a component named in all models except that from the St. Thomas/St. John coastal business community. Although these components are not explicitly identified in the two models, components with similar or related concepts are included. For instance, the St. Croix environmental NGO conceptual model includes “non-extractive human use of the ocean”, “non-commercial spearfishing on scuba”, and “recreational fishing”, all of which are elements of tourism. Similarly, the St. Thomas/St. John coastal business community named several components related to water quality, including “contaminated aquifers”, “runoff”, and “nonpoint source pollution.”

There is also overlap among the identified driver and receiver components across various models, some of which are in the above list of common model components. Note that while component names or descriptions used in models may be slightly different (e.g., “coral” vs. “coral reefs”), each references the same concept and are combined for purposes of identifying the overlaps in driver and receiver components below.

### Driver Component Overlap

- Education: St. Thomas/St. John coastal businesses, Puerto Rico environmental NGOs, Puerto Rico coastal businesses (3)
- Government/Regulatory Agencies/Management: St. Croix environmental NGOs, St. Thomas/St. John coastal businesses, Puerto Rico coastal businesses (3)

### Receiver Component Overlap

- Water Quality: St. Croix environmental NGOs, St. Croix coastal businesses, St. Thomas/St. John environmental NGOs, Puerto Rico environmental NGOs (4)
- Coral/Coral Reefs: St. Croix environmental NGOs, St. Croix coastal businesses, St. Thomas/St. John environmental NGOs, St. Thomas St. John coastal businesses, Puerto Rico businesses (5)
- Reef Fish: Puerto Rico environmental NGOs, Puerto Rico coastal businesses (2).

Note that all conceptual models had either water quality or coral/coral reefs as a receiver component, while all models had at least one driver component related to a human-controlled issue. There was less overlap in driver components than receiver components. This may be due to receiver components across models being comprised primarily of natural resources, while driver components varied according to stakeholder perceptions of cause and effect.

## Appendices

**Appendix 1.** Outreach Materials - Fishery Ecosystem Plan and Conceptual Model briefs (English and Spanish)

**Appendix 2.** Workshop Presentation (English and Spanish)

# Fishery Ecosystem Plans



The Caribbean Fishery Management Council (Council) is responsible for conserving, restoring, and managing the fishery resources in federal waters of the U.S. Caribbean. As part of the Council's work, they are developing a Fishery Ecosystem Plan (FEP), which is a comprehensive plan that acknowledges the connections among fish and other marine life, the changing ocean environment, and the humans who rely on and use these resources.

## What is an ecosystem? What is a fishery? What is a fishery ecosystem plan?

An **ecosystem** is a community or group of living things that interact with one another in a particular environment. There are many types of ecosystems – for example, forest ecosystems, desert ecosystems and coral reef ecosystems. The most important characteristics of an ecosystem are the linkages between living and non-living things.

A **fishery** = fish + people. It consists of a species or group of species and the people who catch those fish. Fisheries can be defined by many characteristics, such as the type of gear used, an area fished, or a user group (e.g. commercial, private angler, charter). Fisheries are systems that have biological, social, cultural, economic, and human components.

A **fishery ecosystem** consists of all the linkages between a fishery (or fisheries) and its components: human (fishermen, processors/dealers, boat mechanics), biological (fish, habitats, predator-prey relationships), social (seafood restaurants, ocean recreation), cultural (fishing-dependent communities), and economic (market demands, costs for fuel, bait, crew, etc.).



A **fishery ecosystem plan** is a road map for a comprehensive management system based on the connections between the biological and human components of fisheries. A fishery ecosystem plan establishes biological, social, cultural, and economic goals for fishery systems. It provides a framework to evaluate the tradeoffs between these components, and indicators to evaluate progress towards the goals. For example, if one goal is to ensure that restaurants have a supply of local, sustainable seafood, one way to evaluate that might be the total number of locally caught species on restaurant menus. Fishery ecosystem plans also allow for consideration of cumulative impacts of multiple activities on a system. This can help managers make more informed decisions.

## What is my role in the development of a Fishery Ecosystem Plan for Puerto Rico and the USVI?

*Stakeholder involvement is the foundation* for determining the connections between the human and biological components of a fishery system. Scientists and managers may not always be aware of all these relationships. Public and stakeholder feedback is critical to identifying the tradeoffs between biological, social, cultural, and economic goals, and ensuring that decisions consider these tradeoffs.

## How is this related to the Council's Island-Based Fishery Management Plans?

The Island-Based Fishery Management Plans established a *new management framework* tailored to each of the islands in the U.S. Caribbean, rather than a framework based on only one species or fishery that extends across all of the islands. This approach recognizes the unique characteristics of each island's fisheries, and that one species or fishery may be more important to an island's fishing communities than another.



The Fishery Ecosystem Plan can be thought of as a “stage” upon which the Island-Based Fishery Management Plans will act. The purpose of the Fishery Ecosystem Plan is to **establish the goals for all components** of a fishery system. The Island-Based Fishery Management Plans are the tools the Council will use to implement actions to achieve these goals. The Fishery Ecosystem Plan will also provide guidance on integrating ecological, economic and cultural information into assessments of different fish populations and decisions about how to manage them. It will be a “living document” that is updated as new information becomes available, and as the Council progresses towards its ecosystem goals.

For more information, please contact Michelle Duval at [michelle@mellivoraconsulting.com](mailto:michelle@mellivoraconsulting.com).

# Planes de Ecosistemas Pesqueros



Jorge Sabater

El Consejo de Administración Pesquera del Caribe (Consejo) es responsable de conservar, restaurar y administrar los recursos pesqueros en aguas federales del Caribe Estadounidense. Como parte de sus esfuerzos, el Consejo está desarrollando un Plan de Ecosistema Pesquero (FEP, por sus siglas en inglés) el cual es un plan integral que reconoce las conexiones entre los peces y otras especies marinas, cambios en el entorno oceánico, así como los seres humanos que dependen de y utilizan estos recursos.

## ¿Qué es un ecosistema? ¿Qué es una pesquería? ¿Qué es un plan de ecosistema pesquero?

Un **ecosistema** es una comunidad o grupo de seres vivos que interactúan entre sí en un entorno particular. Hay muchos tipos de ecosistemas, por ejemplo, ecosistemas forestales, ecosistemas desérticos y ecosistemas de arrecifes de coral. Las características más importantes de un ecosistema son los vínculos entre los seres vivos y los no vivos.

Una **pesquería** = el pescado + la gente. Consiste en una especie o grupo de especies y las personas que capturan esos peces. Las pesquerías se definen por muchas características, como el tipo de arte de pesca utilizado, el área donde se pesca o los tipos de usuarios (por ejemplo, pescadores comerciales, pescadores recreativos, operadores de botes de alquiler). Las pesquerías son sistemas que tienen componentes biológicos, sociales, culturales, económicos y humanos.

Un **ecosistema pesquero** consiste en todos los vínculos entre una pesquería (o pesca) y sus componentes: humano (pescadores, procesadores/comerciantes, mecánica de barcos), biológico (peces, hábitats, relaciones entre depredadores y presas), social (restaurantes de mariscos, recreación oceánica), cultural (comunidades dependientes de la pesca), y económico (demandas del mercado, costos de combustible, carnada, tripulación, etc.).



Un **plan de ecosistema pesquero** es una hoja de ruta para un sistema de manejo abarcador basado en las conexiones entre los componentes biológicos y humanos de la pesca. Un plan de ecosistemas pesqueros establece metas para los componentes biológicos, sociales, culturales y económicos de los sistemas pesqueros. Este plan proporciona un marco para evaluar las compensaciones entre estos componentes e indicadores para evaluar el progreso hacia las metas establecidas. Por ejemplo, si uno de los objetivos es asegurar que los restaurantes tengan un suministro local de pesca sostenible, una manera de evaluar esto podría ser el número total de especies capturadas localmente que se listan en los menús de los restaurantes. Los planes de ecosistemas pesqueros también permiten considerar los impactos cumulativos de múltiples actividades en un sistema. Esto puede ayudar a los manejadores a tomar decisiones más informadas.

## ¿Cuál es mi rol en el desarrollo del Plan de Ecosistema Pesquero para Puerto Rico y las Islas Vírgenes Americanas?

*La participación de la comunidad* es necesaria para determinar las conexiones entre los componentes humanos y biológicos de un sistema pesquero. Es posible que los científicos y manejadores no siempre estén al tanto de todas estas relaciones, por lo cual la retroalimentación de los constituyentes y del público es fundamental para identificar, evaluar y considerar las compensaciones necesarias entre las metas biológicas, sociales, culturales y económicas.

## ¿Cómo se relaciona esto con los Planes de Manejo de Pesquerías por isla del Consejo?

Los Planes de Manejo de Pesquerías por isla establecieron un *nuevo sistema de manejo* adaptado a cada una de las islas en el Caribe Estadounidense, en lugar de un manejo basado en una sola especie o pesquería con las mismas reglas para todas las islas. Este enfoque reconoce las características únicas de las pesquerías de cada isla, y que una especie o una pesquería puede ser más importante para las comunidades pesqueras de una isla que otra.



El Plan de Ecosistema Pesquero puede considerarse como un manual que sirve de guía para la implantación de los Planes de Manejo Pesquerías por isla. El propósito del Plan de Ecosistema Pesquero es **establecer las metas para todos los componentes** de un sistema pesquero. Los Planes de Manejo Pesquerías por isla son las herramientas que el Consejo utilizará para implementar acciones para alcanzar las metas establecidas. El Plan de Ecosistema Pesquero también proporcionará orientación para integrar la información ecológica, económica y cultural en las evaluaciones de las diferentes poblaciones de peces y las decisiones sobre cómo manejarlas. El plan será un "documento vivo" que se actualizará a medida que se obtenga nueva información y a medida que el Consejo se acerque a alcanzar las metas establecidas para el ecosistema.



Para obtener más información, puede contactar a Michelle Duval a [michelle@mellivoraconsulting.com](mailto:michelle@mellivoraconsulting.com)

# Conceptual Models



## What is a conceptual model? How is it used?

A *conceptual model* is a way for a group of individuals to capture knowledge about complex social and environmental issues or systems. Conceptual models are a means of representing and sharing different ideas about a system in order to understand assumptions, commonalities, and differences. They are tools used to identify the key components of a system and the relationships among components. The main goal of a conceptual model is to guide management strategies by identifying factors or particular decisions that may impact identified components. This can help improve collaborative problem-solving and decision-making, as well as communication among stakeholders, scientists, and managers.

## How is a conceptual model developed?

Development of a conceptual model is not complicated. The first step is to *identify the components* of the system of interest. *Components* are things that can increase or decrease in either quantity or quality (e.g., rainfall, happiness, traffic, jobs, populations). They can be social, biological, cultural, or economic in nature. The next step is to *identify the relationships, or linkages, among components*. Linkages are directional, and are either positive or negative (Figure 1).

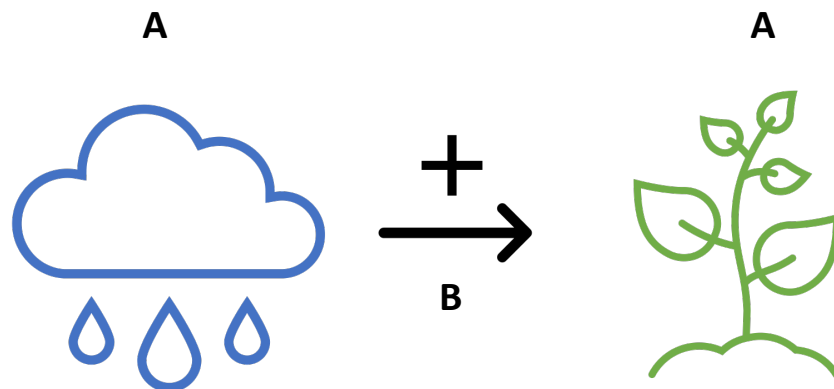


Figure 1: Example illustration of components and impacts. **A** represents two components (rain, a plant) while **B** represents the linkage between the components. The arrow and plus sign show the direction and nature of the impact.

Conceptual models have been developed for a variety of systems, including ecosystems. An example of a conceptual model for a forest ecosystem is displayed below. Note that one component may have a direct linkage to several other components. There is no limit to the components and linkages that may be identified, which allows a conceptual model to be as simple or complex as needed to describe a system.

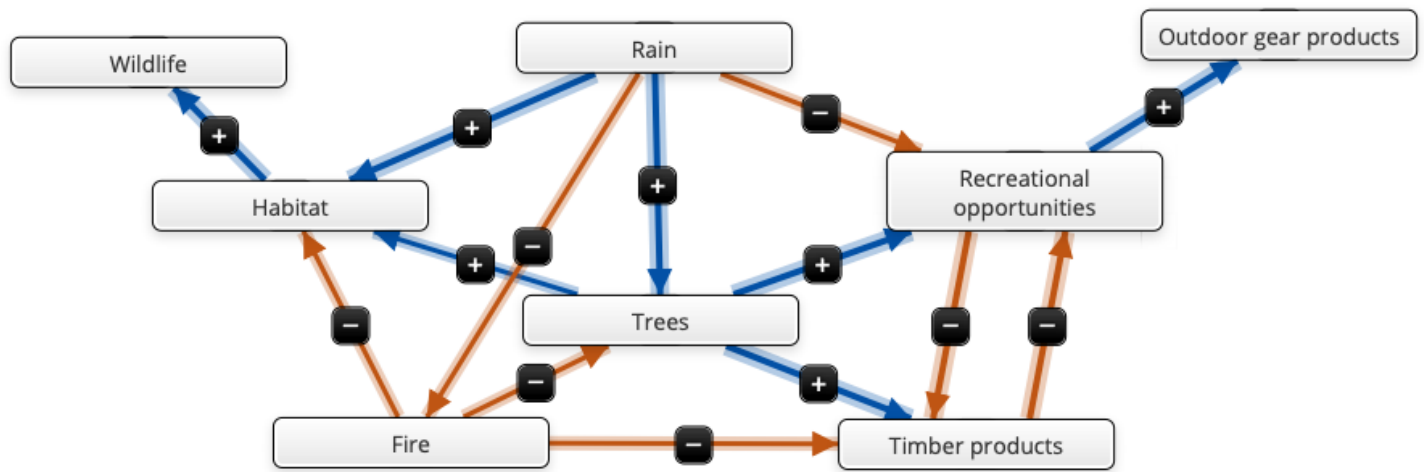


Figure 2: An example conceptual model of a forest ecosystem. Components are represented by symbols. Direct linkages are represented by arrows and plus or minus signs, indicating the direction and nature of impact.

## What is my role in the development of a fishery ecosystem conceptual model for Puerto Rico and the USVI?

*Stakeholder involvement is the foundation* for identifying the components of any system, including a fishery ecosystem. Stakeholder feedback is also critical for determining what the relationships are among the biological, social, economic and cultural components of a fishery ecosystem. Stakeholder groups may also have differing viewpoints on the relationships between the components of an ecosystem. These differences are important to capture so that future decisions appropriately consider any tradeoffs among management goals for a fishery ecosystem.

## How is this related to the Caribbean Fishery Management Council's Fishery Ecosystem Plan?

The Council has been working with various stakeholder groups to develop a series of conceptual models that will inform the development of its Fishery Ecosystem Plan. This effort will complement the work of the Council to ensure that all stakeholder groups have the opportunity to develop conceptual models to identify the components and relationships they believe are most important.

**For more information, please contact Michelle Duval at [michelle@mellivoraconsulting.com](mailto:michelle@mellivoraconsulting.com).**

# Modelos Conceptuales



## ¿Qué es un modelo conceptual? ¿Cómo se usa?

Un *modelo conceptual* es una herramienta que permite que un grupo de individuos obtenga conocimiento sobre problemas o sistemas sociales y ambientales complejos. Los modelos conceptuales son un medio para representar y compartir diferentes ideas sobre un sistema para entender supuestos, puntos en común y diferencias. Además, permiten identificar los componentes críticos de un sistema y las relaciones entre estos componentes. El objetivo principal de un modelo conceptual es guiar las estrategias de manejo mediante la identificación de factores o decisiones particulares que pueden afectar a los componentes identificados. Esto puede ayudar a mejorar la solución de problemas de manera colaborativa y la toma de decisiones, así como la comunicación entre la comunidad, los científicos y los manejadores.

## ¿Cómo se desarrolla un modelo conceptual?

El desarrollo de un modelo conceptual no es complicado. El primer paso es *identificar los componentes* del sistema de interés. *Los componentes* son cosas que pueden aumentar o disminuir en cantidad o calidad (por ejemplo, lluvia, felicidad, tráfico, empleos, poblaciones). Pueden ser de naturaleza social, biológica, cultural o económica. El siguiente paso es *identificar las relaciones, o vínculos entre los componentes*. Los impactos son direccionales y son positivos o negativos (Figura 1).

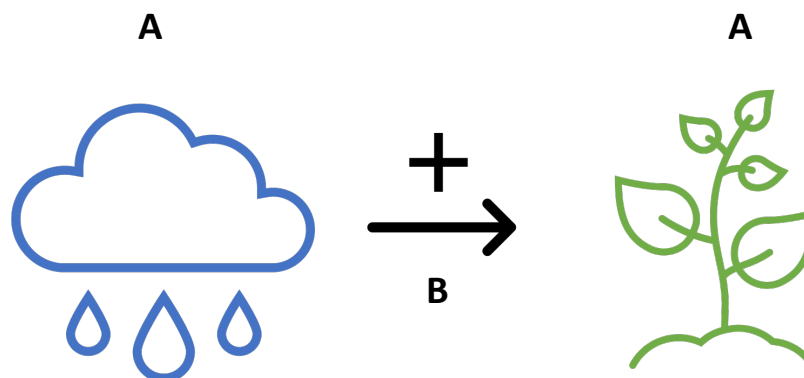


Figura 1: Ejemplo que ilustra componentes e impactos. *A* representa dos componentes (lluvia, una planta) mientras que *B* representa el vínculo entre los componentes. La flecha y el signo de más muestran la dirección y la naturaleza del impacto.

Los modelos conceptuales han sido desarrollados para una variedad de sistemas que incluyen los ecosistemas. A continuación se muestra un ejemplo de un modelo conceptual para un ecosistema forestal. Ten en cuenta que un componente puede tener un vínculo directo con varios otros componentes. No hay límite para los componentes e impactos que se pueden identificar, lo cual permite que un modelo conceptual sea tan simple o complejo como sea necesario para describir un sistema.

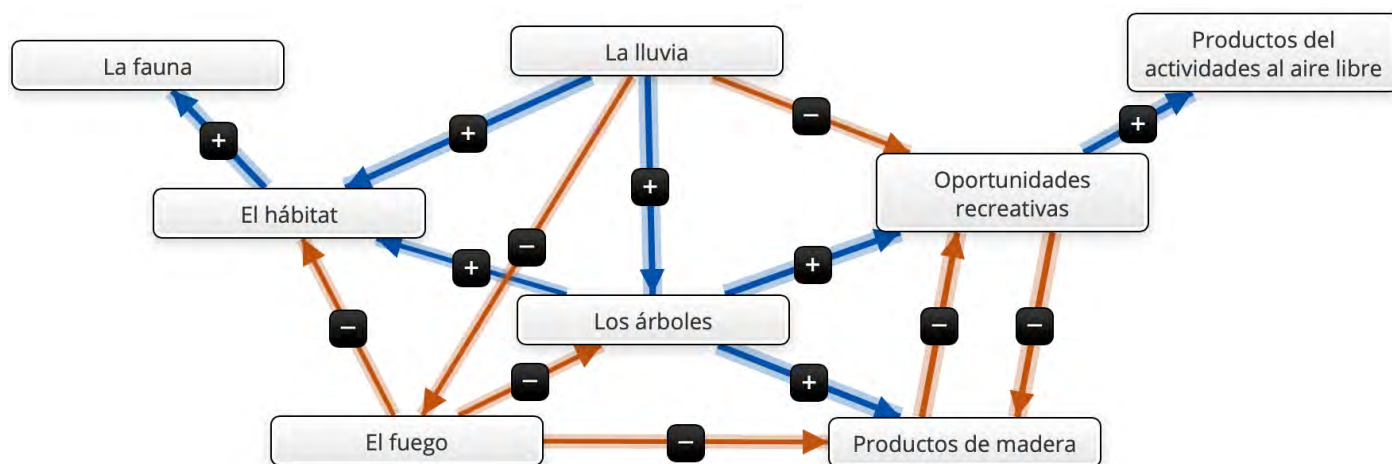


Figura 2: Ejemplo de modelo conceptual de un ecosistema forestal. Los componentes se representan mediante símbolos. Los impactos directos se representan mediante flechas y signos más o menos, lo que indica la dirección y la naturaleza del impacto.

## ¿Cuál es mi rol en el desarrollo de un modelo conceptual de ecosistema pesquero para Puerto Rico y las Islas Vírgenes Americanas?

La *participación de la comunidad* es necesaria para identificar los componentes de cualquier sistema, incluyendo un ecosistema pesquero. La aportación de la comunidad también es fundamental para determinar cuáles son las relaciones entre los componentes biológicos, sociales, económicos y culturales de un ecosistema pesquero. Los grupos de constituyentes también pueden tener puntos de vista diferentes sobre las relaciones entre los componentes de un ecosistema. Es importante identificar estas diferencias para que las decisiones futuras consideren adecuadamente cualquier compensación necesaria entre las metas de manejo de un ecosistema pesquero.

## ¿Cómo se relaciona esto con el Plan de Ecosistemas Pesqueros del Consejo de Administración Pesquera del Caribe?

El Consejo ha estado trabajando con diversos grupos de constituyentes para desarrollar una serie de modelos conceptuales que informarán el desarrollo de su Plan de Ecosistema Pesquero. Este esfuerzo complementará el trabajo del Consejo para asegurar que todos los grupos de constituyentes tengan la oportunidad de desarrollar modelos conceptuales para identificar los componentes y las relaciones que consideran más importantes.

**Para obtener más información puede contactar Michelle Duval a [michelle@mellivoraconsulting.com](mailto:michelle@mellivoraconsulting.com).**

# Fishery Ecosystem Plan Stakeholder Workshop

Puerto Rico Coastal Business Community

May 25, 2021 • 6:00p.m. – 8:00p.m.

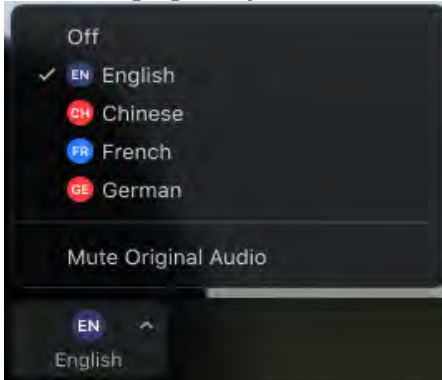
## Listening to language interpretation (laptop or computer)



1. In your meeting/webinar controls, click **Interpretation**.



2. Click the language that you would like to hear.



3. (Optional) To hear the interpreted language only, click **Mute Original Audio**.

### Notes:

- You must join the meeting audio through your computer audio/VoIP. You cannot listen to language interpretation if you use the [dial-in](#) or [call me](#) phone audio features.
- As a participant joining a language channel, you can broadcast back into the main audio channel if you unmute your audio and speak.

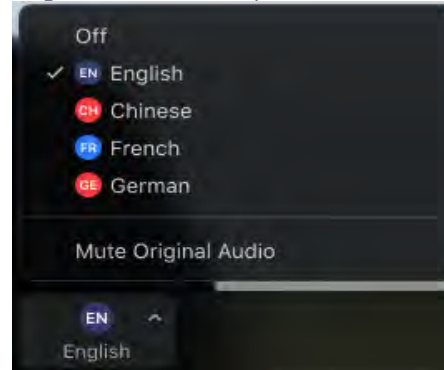
## Instrucciones para escuchar la interpretación a español de la reunión (desde computadora)



1. En los controles de reunión/seminario web, haga clic en **Interpretación**.



2. Haga clic en el idioma que desea escuchar.



3. (Opcional) Para escuchar solo el idioma interpretado, haga clic en **Silenciar audio original**.

### Notas:

- Debe unirse al audio de la reunión a través del audio/VoIP del ordenador. No puede escuchar la interpretación del idioma si utiliza el acceso telefónico o [la función para que el sistema de Zoom le llame a usted](#).
- Como participante que se une a un canal de traducción, puede regresar al idioma original de la llamada si presiona la opción de silencio (mute) y habla.

- **The meeting will be recorded. Any participant who does not want to be recorded can refrain from audio or video participation.**
- **Anyone who does not wish to participate due to the recording can elect to view the recorded presentation later.**

- **Please remember to mute yourself when you are not speaking to reduce background noise.**
- **Please use the “raise hand” feature if you would like to speak.**
- **Please feel free to use the chat box to ask questions or share comments**



Photo: Jorge Sabater

**What is an ecosystem?**

- **Ecosystem** = a community or group of living things that interact with one another

**What is a fishery?**

- **Fishery** = fish + people
- **Fishery ecosystem** = linkages between a fishery and its components

**What is a fishery ecosystem plan?**

- **Fishery ecosystem plan** = comprehensive management system based on the connections between human and biological components of fisheries



Photo: Israel Umpierre

## What's my role in the development of a Fishery Ecosystem Plan for Puerto Rico and the U.S. Virgin Islands?

- **Stakeholder involvement** is the foundation of a fishery ecosystem plan.
- **Determine connections** between human and biological components of a fishery system.
- **Identify tradeoffs** between biological, social, cultural, and economic goals.



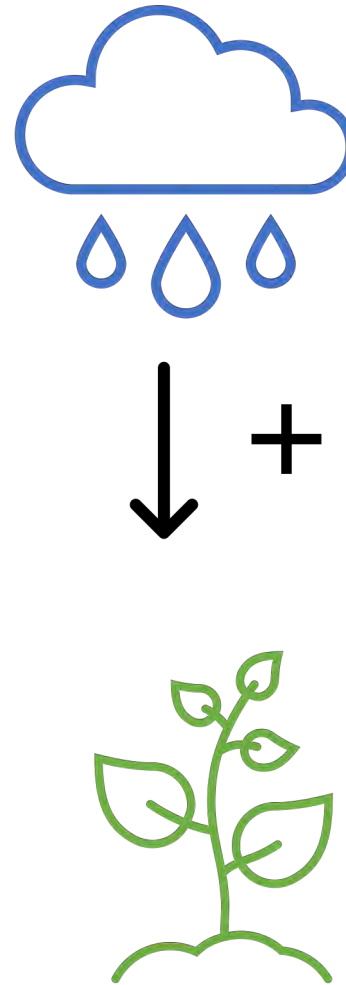
Photo: Jorge Sabater

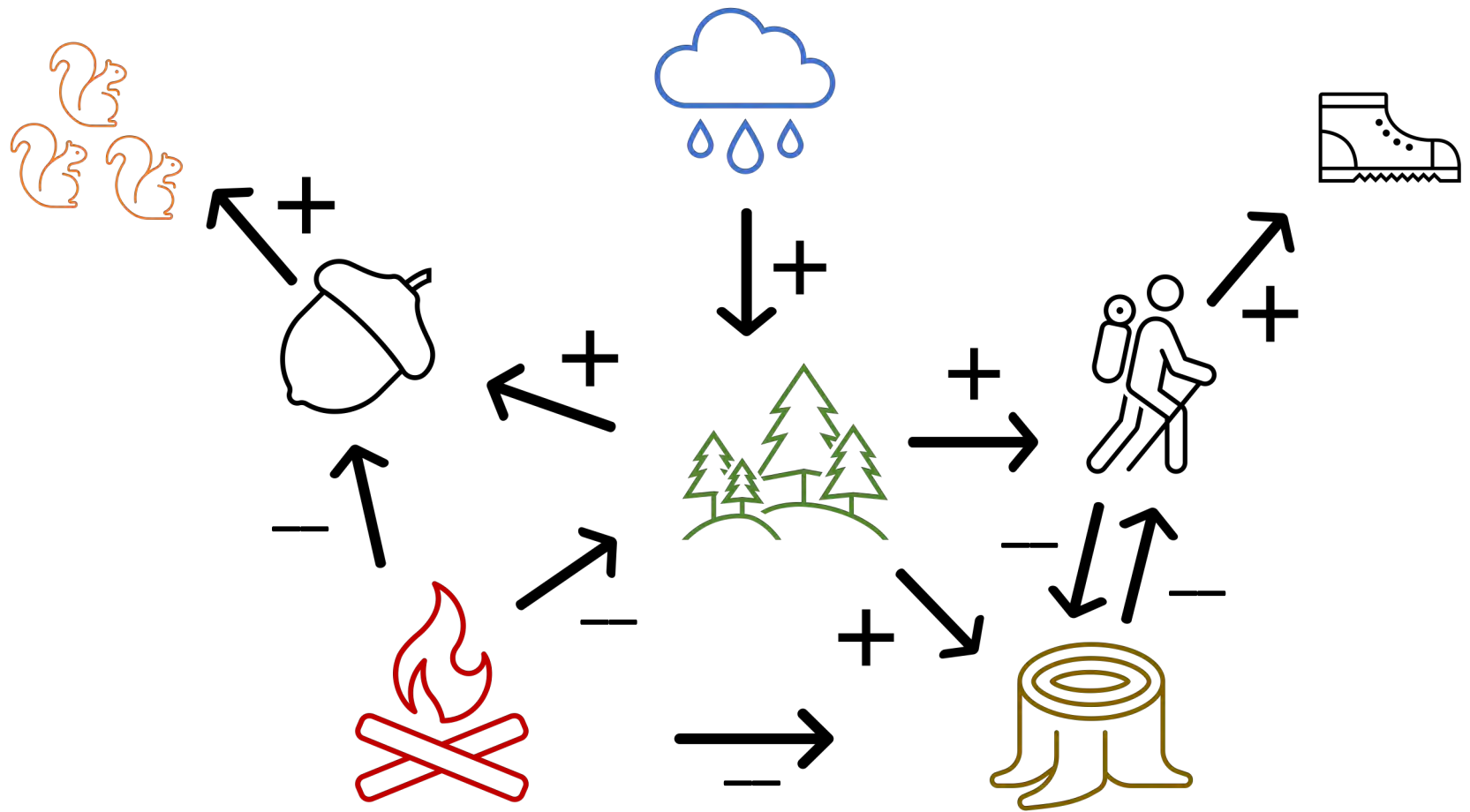
## What is a conceptual model?

- **A way to capture group knowledge** about a complex environmental or social issue
- Represent and share ideas about an issue to **help understand commonalities and differences**
- Improve **collaborative decision-making** and problem-solving

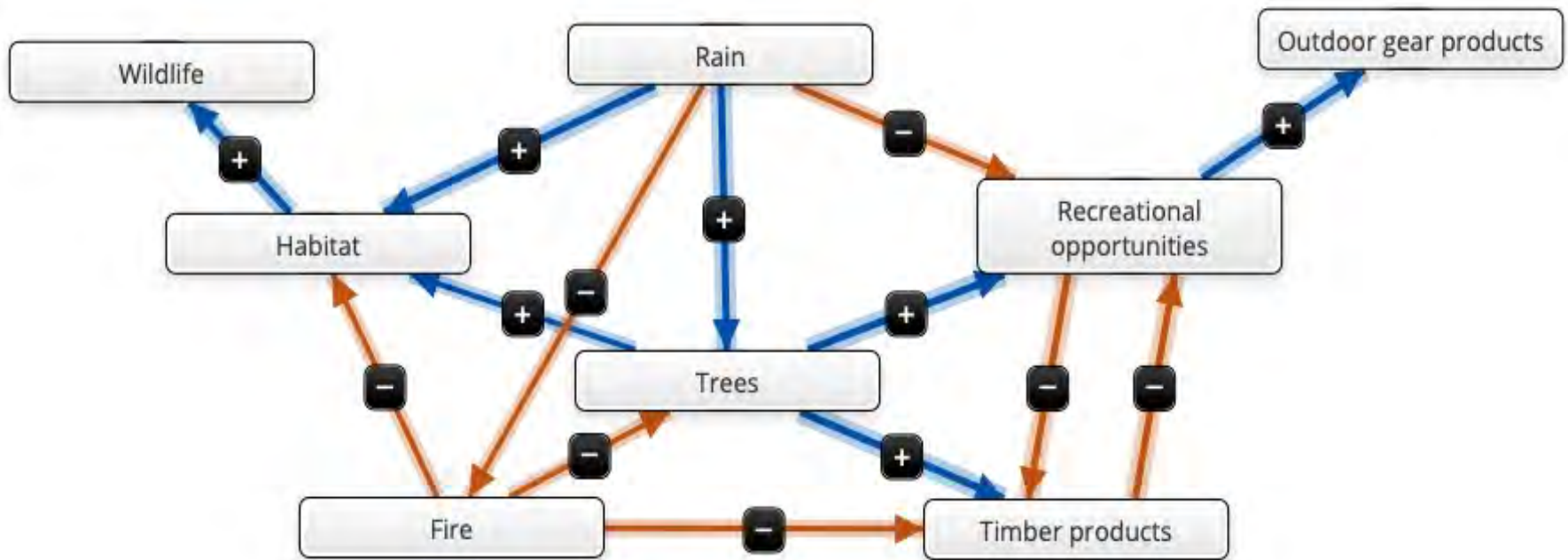
# How is a conceptual model developed?

- Identify the **components** of a system
- Define the **relationships or linkages** among components
- **Components:** Things that increase or decrease in quantity or quality (rain, traffic, populations, happiness)
- **Linkages:** direction (from one component to another) and sign (positive or negative)





**Example: What are the components of a forest ecosystem?**



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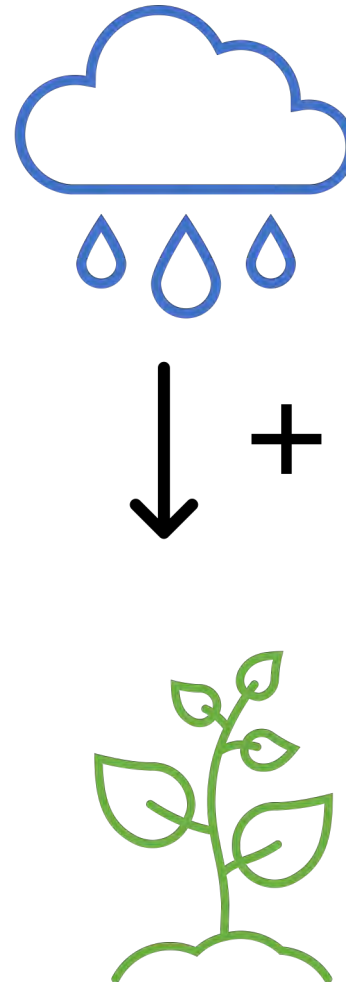
Photo: Michelle Duval

**What do you think are the components of the marine fishery ecosystem in Puerto Rico?**

- **Components:** Things that can increase or decrease in quality or quantity
- Social, biological, economic, cultural, physical
- Individual brainstorming: Think of 3-5 components
- There are no wrong answers!

# How is a conceptual model developed?

- Identify the **components** of a system
- Define the **relationships or linkages** among components
- **Components:** Things that increase or decrease in quantity or quality (rain, traffic, populations, happiness)
- **Linkages:** direction (from one component to another) and sign (positive or negative)



# What are the linkages or relationships among components?

- **Linkages:** Direction (from one component to another) and sign (positive or negative)
- Individual brainstorming: Think of 3 direct linkages or relationships
- There are no wrong answers!

# Questions?

**Michelle Duval**

**Mellivora Consulting**

**[michelle@mellivoraconsulting.com](mailto:michelle@mellivoraconsulting.com)**

**Phone: 919-601-3798**

# Taller de constituyentes sobre el Plan de Ecosistemas Pesqueros

Comunidad de Negocios Costeros de Puerto Rico

25 de mayo de 2021 • 6:00p.m. – 8:00p.m.

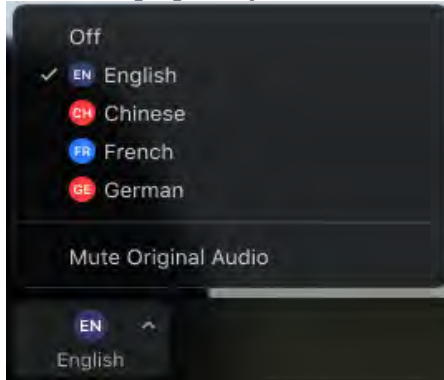
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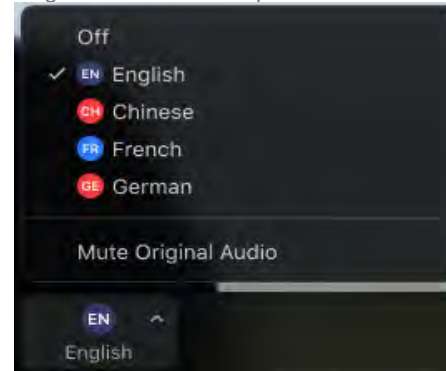
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- Como participante que se une a un canal de traducción de idioma, puede regresar al idioma original de la llamada si presiona la opción de silencio (mute) y habla.

- **La reunión será grabada. Cualquier participante que no desee ser grabado puede abstenerse de la participación en audio o video.**
- **Cualquier persona que no desee participar debido a la grabación puede optar por ver la presentación grabada más tarde.**

- **Por favor, recuerde silenciarse cuando no está hablando para reducir el ruido de fondo.**
- **Por favor, utilice la función "levantar la mano" si desea hablar.**
- **Por favor, no dude en utilizar el cuadro de chat para hacer preguntas o compartir comentarios**



Foto: Jorge Sabater

**¿Qué es un ecosistema?**

**¿Qué es una pesquería?**

**¿Qué es un plan de ecosistema pesquero?**

- **Ecosistema** = una comunidad o grupo de seres vivos que interactúan entre sí
- **Pesquería** = el pescado + la gente
- **Ecosistema pesquero** = los vínculos entre una pesquería y sus componentes
- **Plan de ecosistema pesquero** = un sistema de manejo abarcador basado en las conexiones entre los componentes humanos y biológicos de la pesca



Photo: Israel Umpierre

## ¿Cuál es mi rol en el desarrollo del Plan de Ecosistema Pesquero para Puerto Rico y las Islas Vírgenes Americanas?

- **La participación de la comunidad** es la base de un plan de ecosistema pesquero.
- **Determinar las conexiones** entre los componentes humanos y biológicos de un sistema pesquero.
- **Identificar las compensaciones** entre objetivos biológicos, sociales, culturales y económicos.



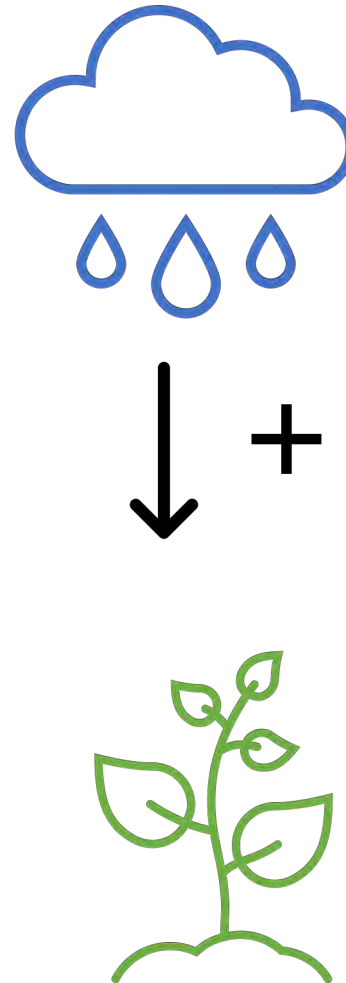
Photo: Jorge Sabater

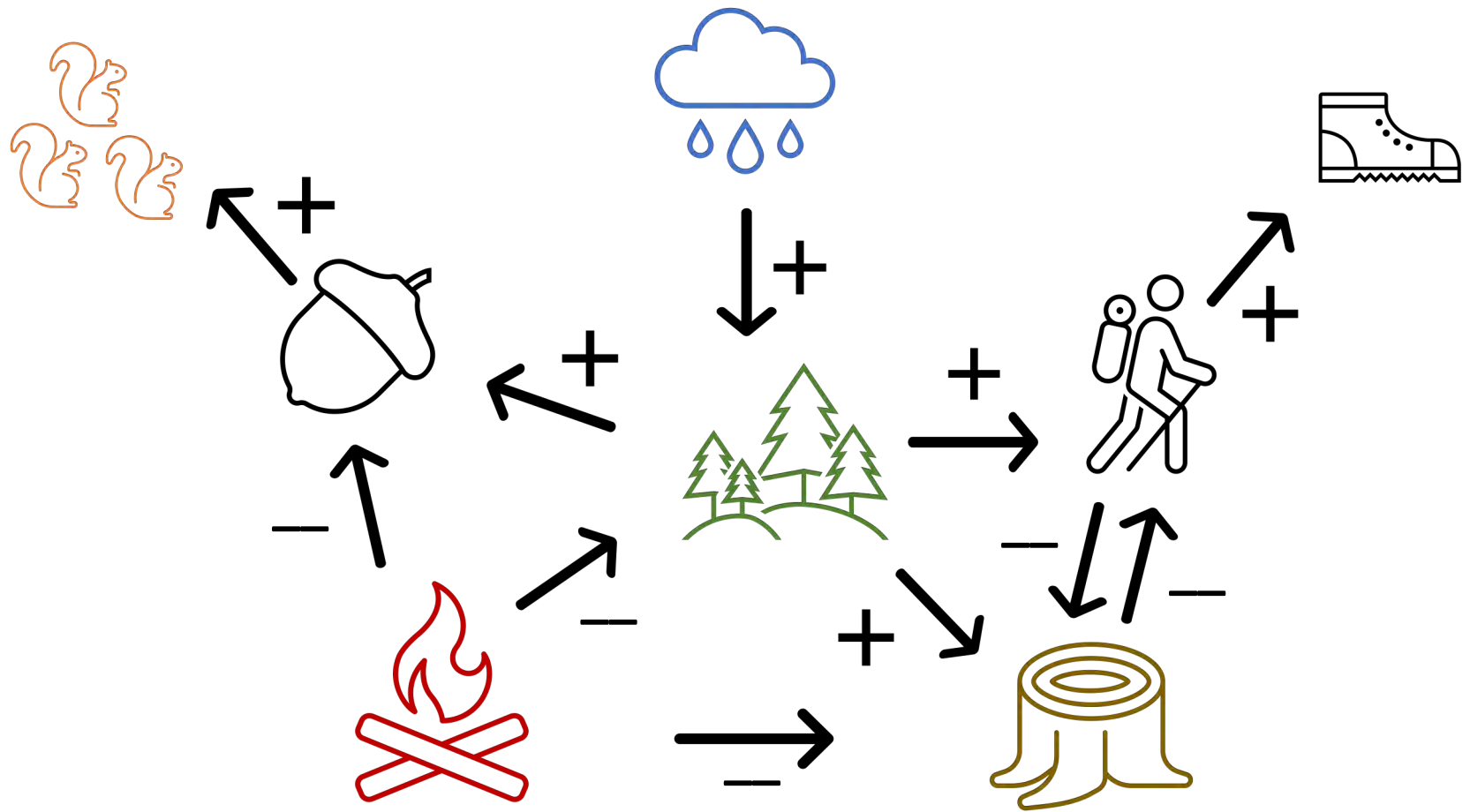
## ¿Qué es un modelo conceptual?

- **Una herramienta que se usa para obtener el conocimiento del grupo** sobre un tema ambiental o social complejo
- Representar y compartir ideas sobre un tema para **ayudar a entender los puntos en común y las diferencias**
- Mejorar la **toma de decisiones colaborativa** y la solución de problemas

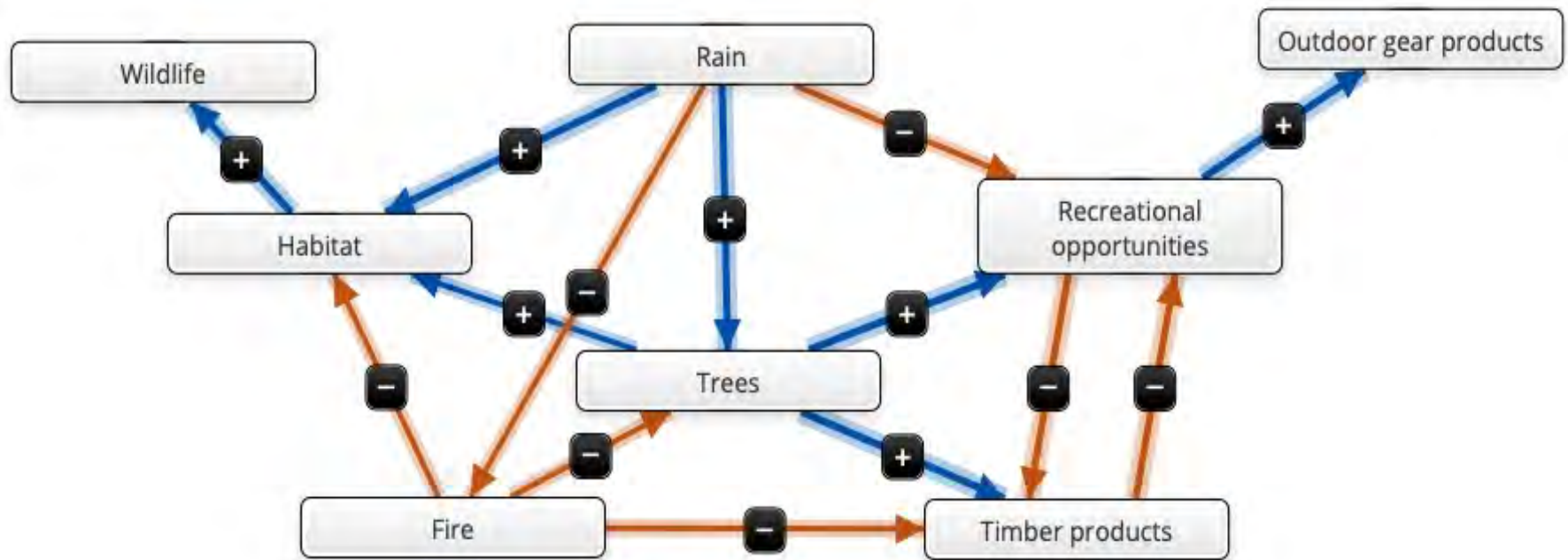
# ¿Cómo se desarrolla un modelo conceptual?

- Identificar los **componentes** de un sistema
- Definir las **relaciones o vínculos** entre componentes
- **Componentes:** Cosas que pueden aumentar o disminuir en cantidad o calidad (lluvia, tráfico, poblaciones, felicidad)
- **Vínculos:** dirección (de un componente a otro) y signo (positivo o negativo)





**Ejemplo: ¿Cuáles son los componentes de un ecosistema forestal?**



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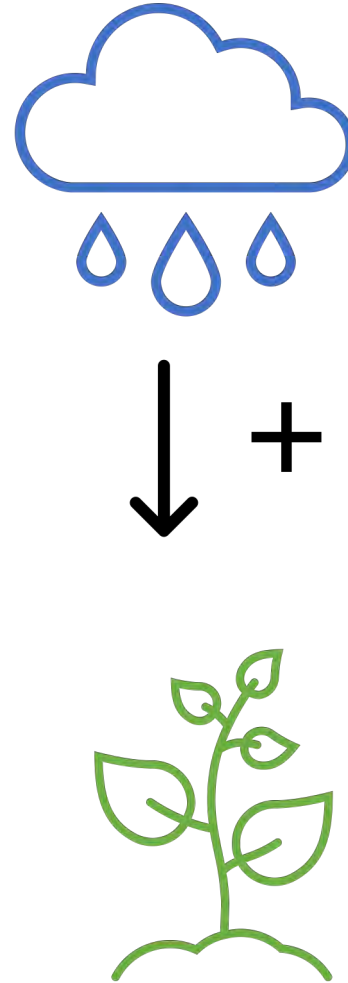
Photo: Michelle Duval

**¿Cuáles cree que son los componentes del ecosistema pesquero marino en Puerto Rico?**

- **Componentes:** Cosas que pueden aumentar o disminuir en calidad o cantidad
- Social, biológico, económico, cultural, físico
- Lluvia de ideas individual: Piense en 3-5 componentes
- ¡No hay respuestas equivocadas!

# ¿Cómo se desarrolla un modelo conceptual?

- Identificar los **componentes** de un sistema
- Definir las **relaciones o vínculos** entre componentes
- **Componentes:** Cosas que pueden aumentar o disminuir en cantidad o calidad (lluvia, tráfico, poblaciones, felicidad)
- **Vínculos:** dirección (de un componente a otro) y signo (positivo o negativo)



# ¿Cuáles son los vínculos o relaciones entre los componentes?

- **Vínculos:** Dirección (de un componente a otro) y signo (positivo o negativo)
- Lluvia de ideas individual: Piense en 3 vínculos o relaciones directas
- ¡No hay respuestas equivocadas!



# ¿Preguntas?

**Michelle Duval**

**Mellivora Consulting**

**[michelle@mellivoraconsulting.com](mailto:michelle@mellivoraconsulting.com)**

**Teléfono: 919-601-3798**