LESSONS FROM THE GALAPAGOS ISLANDS

Organizing Questions

• How does the concept of sustainable development apply to popular tourist areas?
• How can areas with major tourist inflows balance the various elements of sustainability?
• What lessons does the experience of the Galapagos Islands hold for other important tourist hotbeds?

Summary

The Galapagos Islands are one of the most unique locations on our planet. Tourism to the islands has grown exponentially since the 1960s as the islands have become a popular destination for travelers. This has threatened the environmental and social sustainability of the Galapagos, so for decades administrators have tried to apply the concepts of sustainability and sustainable development to manage the growth of tourism in the archipelago. Despite all these efforts, it has proven challenging for the Galapagos Islands to develop sustainably. In the last decade, interesting sustainability science-based studies have been carried out providing tools for decision-making, formulation of public policy, and regional planning in the Galapagos. This talk elaborates on these efforts and the future of sustainable development in the Galapagos Islands.

Materials

Handout 1, Pre-Lesson Quiz
Handout 2, Background on Galapagos’ Approach to Sustainable Tourism
Handout 3, Video Notes
Handout 4, Research on Mass Tourism at Natural Sites
Handout 5, Notes on Presentations
Handout 6, Post-Lesson Quiz
Display 1, Map of Galapagos Islands
Display 2, Debate Question and Instructions
Answer Key 1, Video Notes
Answer Key 2, Post-Lesson Quiz
Teacher Information 1, Mass Tourism at Natural Sites
Teacher Information 2, Video Transcript

### Equipment
- Computer with Internet access and an HTML5-supported web browser
- Computer projector and screen
- Timer to count down one-minute increments during debate

### Teacher Preparation
Instructions and materials are based on a class size of 30 students. Adjust accordingly for different class sizes.

1. Make the appropriate number of copies of handouts.
2. Become familiar with the content of the handouts, answer keys, teacher information sheet, and displays.
4. Set up and test your class computer and projector before starting the lesson.

### Time
Three 50-minute class periods, plus homework between class periods

### Procedures

#### Day One
1. Explain to students that they will spend the next several class periods learning about how sustainable development applies to popular tourist areas and how natural sites that are heavily dependent on tourism, like the Galapagos Islands, are trying to develop sustainably.
2. Distribute one copy of Handout 1, Pre-Lesson Quiz, to each student. Let students know that this quiz is simply designed to discover how much they know about the topic of sustainable development and tourism at this point. The quiz will not be collected or assessed. Allow students 10 minutes to complete the quiz. Ask students to keep the handout to refer to at the end of the lesson.
3. Distribute one copy of Handout 2, Background on Galapagos’ Approach to Sustainable Tourism, to each student. Project Display 1, Map of Galapagos Islands. Allow students five minutes to read through the handout.
4. Distribute one copy of Handout 3, Video Notes, to each student. Instruct students to watch the video and complete this handout before the next class period. Tell students to reserve 90 minutes to watch the video and complete the handout. If time allows, start the video during class and play it until the class is over.

#### Before Day Two
Students watch Video, “A Journey to Achieving Sustainability: Lessons from the Galapagos Islands,” and complete Handout 3, Video Notes. Remind students to reserve 90 minutes to watch the video and complete the handout.

#### Day Two
1. Project Display 2, Debate Question and Instructions, on the projector. Inform the class that they will take part in a debate to answer this question.
2. Divide the class into six groups. Assign three groups to argue for the statement, and the other three groups to argue against it.

3. Allow groups 15 minutes to prepare their arguments. Circulate throughout the class to answer questions and help students prepare their arguments.

4. Call the class together. Facilitate the debate based on the instructions on Display 2, *Debate Question and Instructions*.

5. After the debate, ask the class to vote, by a show of hands, for which argument they personally believed to be more persuasive.

6. Debrief the debate with the following questions:
   - Why do you believe that the side that garnered the most votes won?
   - Which specific points did you find most persuasive?
   - Now that the debate is over, what feedback would you give your rival side for how they could make their argument more persuasive?
   - How did this debate change your thinking about sustainable tourism in the Galapagos Islands?

7. Ask students to brainstorm a list of tourist sites they’re aware of that have taken steps to limit the number of visitors. If possible, write these on your screen or classroom whiteboard.

8. Distribute one copy of Handout 4, *Research on Mass Tourism at Natural Sites*, to each student. Inform the class that this is an assignment that each group member will need to work on individually before the next class period. Ensure that each group assigns one person to each of the six situations before the end of the class period.

9. End the class period by reminding students that they will be sharing what they learned in their research with the other members of their group at the next class period. Use Teacher Information 1, *Mass Tourism at Natural Sites*, to help prompt students if they are unsure about what they should be researching.

Before Day Three

Students work individually to research and complete their assigned question from Handout 4, *Research on Mass Tourism at Natural Sites*.

Day Three

1. Ask students to reconvene in their groups. Distribute one copy of Handout 5, *Notes on Presentations*, to each student.

2. Inform students that they have 30 minutes to share their research with the other members of their group. Each student should write down what they learn on the physical copy of Handout 5, *Notes on Presentations*, which you will collect for assessment after the 30 minutes.

3. After 30 minutes, collect Handout 5, *Notes on Presentations*, from each student.
4. Distribute one copy of Handout 6, *Post-Lesson Quiz*, to each student. Allow students five minutes to complete the handout.

5. If time allows, ask students to share the correct answers to Handout 6. The correct responses are on Answer Key 2, *Post-Lesson Quiz*; you can project this answer key to the class if desired.

**Extension**

Ask students to write a response of 600 to 1,000 words to the following prompt, drawing on what they learned throughout this lesson:

One of your friends tells you that their family has decided to take a 10-day trip to the Galapagos Islands next summer and would like your advice on planning their trip. What would you tell them?

**Assessment**

The following are suggestions for assessing student work in this lesson:

1. Evaluate student responses to Handout 3, *Video Notes*, based on Answer Key 1, *Video Notes*.

2. Evaluate the clarity of student responses to Handout 5, *Notes on Presentations*.


4. Assess student participation in group and class discussions, evaluating their ability to
   - clearly state their opinions, questions, and/or answers;
   - provide thoughtful answers;
   - exhibit sensitivity toward different cultures and ideas;
   - respect and acknowledge other students’ comments; and
   - ask relevant and insightful questions.
Pre-Lesson Quiz

1. How would you define the term “sustainable development”?

2. Have you heard the term “overtourism”? If so, in what context? Whether or not you’ve heard the term, write down your best guess at a definition.

3. Do you believe that too many tourists can be bad for a destination? Why or why not?

4. In what ways are the Galapagos Islands unique?
BACKGROUND ON GALAPAGOS’ APPROACH TO SUSTAINABLE TOURISM

Tourism, like any other economic activity, can be sustainable or unsustainable. Tourism drives most of the economic activities in the Galapagos Islands, so it has a strong influence on the social and environmental health of the archipelago.

The administrators of the Galapagos National Park have been trying to reinvest the benefits of tourism collected through entrance fees and annual operation fees into the social and natural capital of the archipelago without compromising the stability of the social-ecological system, particularly the islands’ natural assets—which of course is what attracts tourists to the islands in the first place.

The Galapagos National Park Management Plan of 2006 introduced the concept of the Galapagos Islands as a social-ecological system. This vision was reinforced in the current management plan that covers the period of 2014 to 2024.

The first quantified study of sustainable tourism in the Galapagos took place in 2013. This study used data to outline three scenarios for how tourism growth would affect the social-ecological system of the archipelago, including local population growth. The Galapagos holds a local human population of 33,000 people that was growing at a six percent annual rate at the time of the study due to migration to support activities linked to tourism.

The three scenarios were selected to show the range of possible effects of the unprecedented growth of tourism on the social, ecological, and economic variables of the archipelago. They were: 1) exponential growth in tourism; 2) lineal or constant growth in tourism; and 3) no growth in tourism. The model also attempted to quantify the “point of no return” and how to avoid reaching it.

The worst-case scenario (scenario 1) assumed a continued tourism growth rate of around 8–10 percent per year. Models showed that this continued rate of growth in tourism would push the islands past the ecological point of no return by the year 2026. In the second scenario, where tourism grows at a steady 3.8 percent annual rate, the islands reached the point of no return in 2030, as this growth rate creates unsustainable conditions for many of the variables modeled. The only scenario in which the point of no return could be avoided was the third scenario, in which tourism did not grow at all.

Overall, the study implied that it will take strong political decisions based on scientific information and well-informed community processes to keep tourism to the Galapagos from compromising the health and vitality of the islands’ natural and social assets.
VIDEO NOTES

You are about to watch a 40-minute video from Dr. Arturo Izurieta Valery about sustainability and sustainable development in the Galapagos Islands of Ecuador. The Galapagos are ecologically unique and have been designated a UNESCO World Heritage Site, which creates an obligation to preserve the archipelago’s unique ecosystems. However, tourism is the backbone of the islands’ economy, and many Ecuadorians have moved to the Galapagos to meet the growing demand for labor and to improve their standard of living. This population growth puts pressure on basic local services such as potable water, solid waste management, health services, transport, and fuel consumption.

Like other unique tourist destinations based on natural beauty, applying sustainable development concepts to the Galapagos Islands has not been easy. This talk discusses the history of attempts to make tourism to the Galapagos sustainable and the conclusions of the first study on how the Galapagos can develop sustainably. Lessons from this study apply to many other popular natural destinations in the world that are in danger of being “loved to death.”

Use the space below to answer each question; you may want to take notes on another sheet of paper as you watch the video.

1. What three definitions of sustainable development does Dr. Izurieta Valery cite?

2. Why is it so important to maintain the Galapagos’ unique ecosystems?

3. What are at least five key events since the 1950s that have contributed to more sustainable development in the Galapagos?
4. What are the main threats to the Galapagos Islands’ sustainability?

5. What were the main recommendations from the 2013 study that modeled how tourism to the Galapagos could proceed sustainably?

6. What additional recommendations does Dr. Izurieta Valery have after COVID-19?

KEY TERMS (in order of mention)

**UNESCO World Heritage Site**—designation for places on Earth that are of outstanding universal value to humanity and as such, have been inscribed on the World Heritage List to be protected for future generations to appreciate and enjoy.

**sustainable development**—development without growth beyond environmental limits; development that meets the needs of the present without comprising the viability of future generations.

**endemic**—peculiar to a particular area or region; not found in other places.

**United Nations Sustainable Development Goals**—a set of 17 goals adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity.

**Philornis downsi fly**—a parasitic species of fly in the *Philornis* genus that was accidentally introduced to the Galapagos Islands and now poses a major threat to the survival of some of its endemic birds.

**Galapagos National Park Directorate**—the Ecuadorian governmental institution responsible for the administration and management of the protected areas of the Galapagos Islands.

**Galapagos Biosecurity Agency**—agency of the Ecuadorian government whose mission it is to control, regulate, and reduce the risk of introduction and dispersal of exotic species by any means that put the biodiversity of the Galapagos islands, the local economy, and human health at risk.
The Galapagos is not the only tourist destination to struggle with the potential downsides of too many tourists. Many other famous natural sites throughout the world have taken steps to ensure that tourism does not threaten their sustainability; some of these steps are quite dramatic.

To learn about how other natural sites have addressed the threat of potential overtourism, your group will now choose six other destinations to research. Work with your group partners to choose six of the destinations listed below (or even choose a different one if you know it well). Then, each of you will need to conduct research before the next class period to share what you discover with the other members of your group.

**STEP 1: DISCUSS AND CHOOSE YOUR DESTINATION TO RESEARCH**

Each person in your group needs to choose one natural destination. Select from the following list, or choose another destination that interests you:

| GREAT BARRIER REEF, AUSTRALIA | MT. KILIMANJARO, TANZANIA |
| HANAUMA BAY NATURE PRESERVE, HAWAII, USA | VOLCANOES NATIONAL PARK, RWANDA |
| INCA TRAIL AND MACHU PICCHU, PERU | YOSEMITE NATIONAL PARK, USA |
| MT. FUJI, JAPAN |

**STEP 2: WRITE DOWN YOUR GROUP’S ASSIGNMENTS**

Record your group assignments in the table below.

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STEP 3: CONDUCT RESEARCH AND PREPARE TO SHARE YOUR RESPONSE

Research your assigned destination individually as homework. Use reliable sources to find answers to the questions below. Document your answers and bring them to the next class period, where you will share these responses with the other members of your group.

1. What were the specific concerns about the impact of mass tourism on this site?
2. What steps have been taken to better manage the impact of mass tourism on this site? When were these measures put in place?
3. How effective have these steps been? To what extent do experts describe the current tourism impact as sustainable?
4. What are some lessons from this case you believe could be applied to other popular natural tourist destinations?
# Notes on Presentations

Use the table on the following pages to take notes on your groupmates’ response to their assigned destination. Your teacher will collect your responses for assessment.

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POST-LESSON QUIZ

1. How would you define the term “sustainable development”?

2. Have you heard the term “overtourism”? If so, in what context? Whether or not you’ve heard the term, write down your best guess at a definition.

3. Do you believe that too many tourists can be bad for a destination? Why or why not?

4. In what ways are the Galapagos Islands unique?
Display 1

Map of Galápagos Islands

Source: National Geographic Society
DEBATE QUESTION AND INSTRUCTIONS

STATEMENT TO DEBATE

“The only way for the Galapagos Islands to achieve sustainable development is to limit the number of tourists who visit each year.”

DEBATE INSTRUCTIONS

1. At random, the teacher will select one of the three groups arguing against this proposition to make its argument.
2. That group has up to five minutes to state its argument. Each person can speak for no more than one minute. After the first speaker’s minute is over (or they finish making their point), the speaker must “tag” another member of their team to continue making their case. Any other team member can raise their hand to be tagged.
3. After the “against” side is done, the teacher will randomly call on one of the three groups arguing for the proposition to make its argument. The “for” side has five minutes to make its points, using the same tag protocol described above.
4. Next, any other person assigned to argue the against side can add to that side’s argument. As above, each person has only one minute to speak until five minutes have passed.
5. Finally, any other person assigned to argue the for side can add to that side’s argument. Again, each person has only one minute to speak; this continues for up to five minutes.
1. What three definitions of sustainable development does Dr. Izurieta Valery cite?

Dr. Izurieta Valery introduces three definitions for sustainable development:

- The Brundtland Commission defined the term as “development that meets the needs of the present without comprising the ability of future generations to meet their own needs.”
- Herman Daly defines it as “development without growth beyond environmental limits.”
- Dr. Izurieta Valery also mentions the academic definition, which is “an analytical field of study that aims to explain and predict the complex and nonlinear interactions of human and natural systems.”

2. Why is it so important to maintain the Galapagos’ unique ecosystems?

The Galapagos Islands are unique in many ways that have allowed for an exceptional number of endemic species to develop and survive there. First, they are relatively isolated and had no human settlements until 200 years ago. Many ocean currents converge near the islands, providing conditions for a wide variety of terrestrial and marine wildlife to thrive. The islands also have active volcanic activity. They are so unique that UNESCO named them one of the first World Heritage Sites in 1978.

3. What are at least five key events since the 1950s that have contributed to more sustainable development in the Galapagos?

Several events could be mentioned; here are those covered in the lecture:

- **1959**: Galapagos National Park is established, covering around 97 percent of the land mass of the islands.
- **1959**: The Charles Darwin Foundation for the Galapagos Islands is created to support the conservation of the islands by establishing the Charles Darwin Research Station.
- **1973**: The Galapagos Islands become an independent province of Ecuador.
- **1978**: UNESCO registers the Galapagos Islands as one of the first 10 World Heritage Sites.
- **1980**: Galapagos National Institute is established to coordinate the appropriate development of the islands at the national level of Ecuador’s government, along with the municipalities of the Galapagos and a representative from conservation organizations.
- **1986**: Galapagos Marine Resources Reserve is created, protecting 15 nautical miles around the islands.
- **1998**: Ecuador’s constitution is amended to allow for the Special Law for Galapagos that restricts movement to the islands. The Special Law also creates the Galapagos Marine Reserve, protecting 40 nautical miles around the islands.
- **2014**: The Galapagos Protected Areas and Good Living Plan goes into effect.
- **2021**: Galapagos Strategic Plan 2030, intended to guide sustainable development of the archipelago for 10 years, is approved and published.

4. What are the main threats to the Galapagos Islands’ sustainability?

Some of the threats and challenges mentioned are:

- Exponential growth of tourism since the late 1960s
- Annual 3.5 percent increase in the resident population
• Increase of introduced species, including more than 800 species of invasive plants and invasive animals like the Philornis downsi fly
• Pressure from fisheries: more species, more amounts, more areas
• Pressure to increase the number of tour operators and visitor sites
• Poor urban and rural planning
• Poor basic public services (potable water, health services, hospitals, education, public transport)
• Poor funding for science and conservation
• Climate change and pollution

5. What were the main recommendations from the 2013 study that modeled how tourism to the Galapagos could proceed sustainably?
   According to Dr. Izurieta Valery, the main recommendations were:
   1. Stabilize of number of tourists visiting the Galapagos per year to 243,000 by 2017 by:
      a. limiting flight frequencies to the islands
      b. increasing the entrance fee to the National Park and Marine Reserve
   2. Invest in:
      a. improving tourism and public services
      b. strict and improved quarantine capacities (Galapagos Biosecurity Agency)
      c. improving Galapagos National Park budget
      d. science and education (including environmental education)
      e. local institutional capacities (municipalities)
      f. reducing the use of fossil fuels and improve mobility
   3. Generate greater capacity to assess and monitor the behavior of the Galapagos system
   4. Inform the resident community about the sustainability of the Galapagos and allow them to participate in key decisions around sustainable development

6. What additional recommendations does Dr. Izurieta Valery have after COVID-19?
   • Diversify the economy of the islands for better resilience so they can better weather another external shock like a pandemic
   • Articulate land-based tourism with the tourism regulated by the national park
   • Municipalities in the Galapagos need to work together as part of a socio-economic and environmental system
   • Be innovative in pursuing sustainability rather than returning to business-as-usual
   • Reinforce community participation in decision
POST-LESSON QUIZ

1. How would you define the term “sustainable development”?
   
   In most contexts, sustainable development refers to a balance among economic growth, ecological vitality, and human health. The United Nation’s World Commission on Environment and Development defines the term as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

2. Have you heard the term “overtourism”? If so, in what context? Whether or not you’ve heard the term, write down your best guess at a definition.

   Overtourism occurs when the number of visitors to a destination exceeds its carrying capacity, leading to a range of social, environmental, and economic problems. The World Tourism Organization defines overtourism as “the impact of tourism on a destination, or parts thereof, that excessively influences perceived quality of life of citizens and/or quality of visitor experiences in a negative way.” If students have heard of this term, it has likely been through news reports detailing how too many tourists place immense burdens on popular travel destinations.

3. Do you believe that too many tourists can be bad for a destination? Why or why not?

   Too many tourists can be bad for a destination for several reasons:
   • They can put a strain on the natural environment through waste, pollution, or habit destruction.
   • They can make it hard for residents to live their daily lives due to increased traffic.
   • Large numbers of tourists create demand for more energy, food, transit, and water.
   • Tourist activities and services often demand skillful people that are not always found locally, thus, generating immigration to the tourist site.
   • Tourists can drive up the price of local goods and services like housing, food, and private transportation. This is especially problematic when the local population is generally poorer than tourists.
   • Destinations may become too reliant on tourism for income, which makes them particularly vulnerable when tourism wanes due to economic downturns, natural disasters, pandemics like COVID-19, or other unforeseen travel disruptions.

4. In what ways are the Galapagos Islands unique?

   • The isolation of the Galapagos Islands and the influence of four major ocean currents has allowed for the evolution of distinct and endemic species that have adapted to the specific conditions of the islands. This has given the Galapagos their famous biodiversity: they house many species found nowhere else on the planet, including the iconic Galapagos giant tortoises, marine iguanas, and Galapagos penguins. Charles Darwin’s observations of these unique species during his visit to the islands in 1835 played a crucial role in the development of his theory of evolution by natural selection.
   • Underwater, several major ocean currents converge in the Galapagos region, bringing nutrient-rich waters to the surface and creating a unique marine environment that supports a wide range of marine species.
   • The archipelago’s isolation and biodiversity make it a living laboratory for scientists and researchers studying evolution, ecology, and biodiversity.
MASS TOURISM AT NATURAL SITES

Some of the steps taken to reduce the number of tourists at the natural destinations listed on Handout 4, Research on Mass Tourism at Natural Sites, are listed below. This information is not comprehensive and is current as of October 2023.

Use this information to give ideas to groups as they complete the assignment on Handout 4 rather than as an “answer key.”

1. Great Barrier Reef, Australia

Source:
- Official site: https://www2.gbrmpa.gov.au/

Specific measures:
- Certain areas of the Great Barrier Reef are designated as restricted access areas that visitors cannot enter without special authorization. These areas are typically of high ecological importance or have sensitive habitats.
- The park has mapped the reef into specific zones based on activity, including diving, snorkeling, and boating, to minimize the impact on sensitive coral reef ecosystems.
- Tour operators must abide by specific regulations and guidelines for responsible diving and snorkeling practices, to prevent damage to the coral and marine life.

2. Hanauma Bay Nature Preserve, Hawaii, USA

Sources:
- Official site: https://pros3.hnl.info/hanauma-bay
- FAQs: https://hanaumabaystatepark.com/frequently-asked-questions/

Specific measures:
- The nature preserve is closed on Sundays and Mondays.
- No entry is allowed into the nature preserve after 1:30pm, and all visitors must leave by 4:00pm.
- All visitors must watch an orientation video that explains how to enjoy the bay responsibly.
- Parking is restricted to limit the number of vehicles and people who enter the preserve.
- The amount of guests is capped at 1,400 per day; every visitor (except for residents of Hawaiʻi) must register two days ahead for time for a time slot to enter the preserve.
3. Inca Trail and Machu Picchu, Peru

**Source:**
- Official site: [https://www.machupicchu.gob.pe/?lang=en](https://www.machupicchu.gob.pe/?lang=en)

**Specific measures:**
- Machu Picchu has a cap on daily visitors. This limit was set at 4,044 in 2023.
- Tourists are limited to four hours within the sanctuary of Machu Picchu.
- Visitors to Machu Picchu must choose one of five “circuits” for their trip and must stay within that area.
- Trekkers on the Inca Trail must hire and travel with licensed guides to ensure that they follow designated paths and adhere to responsible tourism practices.
- The Peruvian government uses a permit system to limit the number of hikers on the trail. All hikers must obtain a permit; no more than 500 people are allowed on the trail each day, of which only 200 are trekkers. The rest are guides and porters.
- Each group on the Inca Trail must have 16 or fewer people.
- The Inca Trail closes every February for cleaning and maintenance.

4. Mt. Fuji, Japan

**Sources:**

**Specific measures:**
- Climbing is limited to four designated trails.
- Climbing Mt. Fuji is a multiple-day experience, so almost all visitors need to stay one night on the mountain. Camping is not permitted, but there are official huts. Reservations for huts are required, and in 2023 the accommodation capacity of huts was only one-half of that before COVID-19.

5. Mt. Kilimanjaro, Tanzania

**Source:**
- Official site: [https://www.tanzaniaparks.go.tz/national_parks/kilimanjaro-national-park](https://www.tanzaniaparks.go.tz/national_parks/kilimanjaro-national-park)

**Specific measures:**
- Climbers must obtain permits to attempt the ascent of Mount Kilimanjaro. The amount of permits issued is limited to control the overall number of climbers on the mountain.
- Climbers must stay on one of the pre-determined routes on the mountain.
- Tourists are not allowed to climb on their own. A licensed local guide must be hired to accompany all visitors on the mountain.
- Climbers must pack out all their non-biodegradable waste to preserve the natural environment and prevent pollution.
6. Volcanoes National Park, Rwanda

Sources:
- Overview of rules: https://www.volcanoesnationalpark.org/park-information/park-rules/

Specific measures:
- Visitors must hire trained local guides to explore the park. Guides ensure tourists stay on designated trails.
- Tourists need to buy permits to visit the park. A limited number of permits available each day to regulate the number of visitors and minimize disturbance to the gorilla habitats.

7. Yosemite National Park, USA

Sources:
- Official site: https://www.nps.gov/yose/planyourvisit/index.htm

Specific measures:
- Yosemite uses a reservation system for certain popular areas within the park, including campgrounds and specific trails, to manage the number of visitors during peak seasons and prevent overcrowding.
- The park provides frequent shuttle services throughout the popular Yosemite Valley to reduce traffic congestion and minimize the environmental impact caused by private vehicles.
- In 2020 and 2021, the park piloted a reservation system due to the pandemic. In 2022, the park implemented a "peak hours" reservation system due to extensive construction throughout the park.
- Reservations were also required for three weekends in February 2023 to help manage crowding and associated impacts during the Horsetail Fall "firefall" event. The park website states:
  "Historically, the sunset backlight on Horsetail Fall was little known. However, in recent years, visitation around this event has increased dramatically. For example, on February 19, 2022, 2,433 visitors viewing Horsetail Fall gathered in areas mostly lacking adequate parking and other facilities. In prior years, visitors have spilled onto riverbanks, increasing erosion and trampling vegetation. As riverbanks filled, visitors moved into the Merced River, trampling sensitive vegetation and exposing themselves to unsafe conditions. Some undeveloped areas became littered with trash, and the lack of restrooms resulted in unsanitary conditions."
So I’m going to talk to you about, today, the Galapagos Islands, but the theme of sustainability and sustainable development as key aspects of it, briefly commenting on both terms. Then we’re going to pass on to the Galapagos context. Then, as the next part of the talk, walking through the steps of the efforts towards a sustainable Galapagos, and then share with you the research that I started with the help of some students that I see here accompanying us today on the sustainability of the island of Floreana and end up with final remarks.

So we have to depart with a premise, and this is universal, must be universal: healthy ecosystems and environments are needed to the survival of us all, humans and also all living creatures that exist in the planet. So with that premise, we jump on the term of sustainability, which is a combined word that if we go to the Latin and what derives from the Latin sustainere—sustain, support, endure—and ability, from the Latin habilis—which means apt, being able, to be skillful—we summarize it as being “able to maintain” whatever that is: that’s sustainability. And the term was initially used in fisheries, from what I’ve picked up from the literature, and basically the property of the biological systems to remain diverse and productive indefinitely. So in the fishing industry, they really wanted to be sustainable, to have the stocks of fish for the future.

So entering into sustainable development, the term was used initially in 1987 during the Brundtland Commission. And—I think that was Stockholm, if I’m not wrong—but the emphasis was on development that meets the needs of the present without comprising the ability of the future generations. So the intergenerational aspect is mentioned in this definition.

Later on, and I like this definition from Herman Daly, defines sustainability or sustainable development as “development without growth beyond environmental limits.” So he brings in the environmental limits into the equation. And one that I have recently picked up, which is related to the studies, the academic, the science, he refers as “an analytical field of study that aims to explain and predict the complexity of the social-environmental systems that govern us all.”

So in the end I think we come up with a simple graph that most of us have seen around and that tries to interpret that there’s a need to have a balance between the social, environmental, and economic aspects as pillars of sustainability. But having a look at the term sustainability and sustainable development, I found that there are elements that coincide, that they share—they seek to prosper or do well economically and socially—with the intergenerational aspect, which is for the present and the future generations and conserving the earth’s life support systems, nature, environment that feed us all.

So with this brief introduction then we jump into our case study, the Galapagos Islands. So where are the Galapagos Islands compared to where we are now? It’s over 4,000 kilometers away but they are islands that are off the coast of Ecuador, about 600 miles off the coast. And it’s an archipelago that is composed by 13 major islands and more than 100 rocks and islets with four inhabited islands: San Cristobal, Santa Cruz, Isabela, and Floreana. Ninety-seven percent of the landmass of the islands is national park and surrounded by 138,000 square kilometers of protected area as a marine reserve. The population of Galapagos, the human population, is about 33,000 people distributed on these four islands that I just mentioned.
Now Galapagos is a place that is in constant formation. At least the ones that we have, the islands we have today, appeared three to five million years ago. We had our last eruption last year, it lasted three months, a volcano on Isabela. And it’s a unique place because I haven’t really found more literature about a place that has the influence of so many ocean currents at the same time, stronger or weaker depending on the season, but they are there, present, bringing lots of influences to the terrestrial area, special habitats and ecosystems, marine and terrestrial, that have definitely been essential for the creation or the evolution of many species and most of them are endemic.

Marine birds are endemic to the islands. We have a few species of cormorants, albatrosses, we have penguins right there on the equator. Patches of coral as well and reptiles like the famous giant tortoise. All the reptiles are endemic, with some few introduced ones. And birds: land birds, like the mockingbirds and the Darwin finches that gave Darwin the inputs to develop his theory of the origin of species through natural selection. But let’s don’t forget the marine environment, where we do have species that are essential for the health of the marine life in the region, but also important for fisheries, local artisanal fisheries in Galapagos, like lobsters and groupers, but also important for the tourism and conservation.

The other important aspect of Galapagos is the recent colonization. Pretty much Galapagos, as volcanic, had never had an indigenous population of humans like in Micronesia, for example. They were pretty much barren, empty. So I’m going to just highlight some of the key milestones that I consider important sharing with you. That’s 1832 where the Galapagos Islands really claim, are claimed by, Ecuador as part of its territory. Three years later, the famous naturalist arrives to the islands in 1835, Charles Darwin, who really put the Galapagos out to the world because of his theory. Another important landmark is the penal colonies that were established in Galapagos. But there is one that I think it’s important because it was on the island of San Cristobal in the late 1800s and it lasted until 1903. And when that was abolished then many people migrated to other of the islands or stayed on the island of San Cristobal.

The governance structures, the institutionalization of the islands, is important as well. The institutions that landed on the island or recently colonized island. So the national park was established in 1959 and along with the Galapagos National Park came the Charles Darwin Foundation, the Charles Darwin Research Station, and the administration of the Ecuadorian Institute, the national park. In 1973, the Galapagos Islands become a province. So geopolitically speaking, the islands before 1973 belonged politically, the decisions were taken in the mainland in the province of Guayas, but in 1973 it became independent and of course that introduced the recognition of three municipalities and of course elections to the dignitaries started since then, and the decisions were pretty much in the hands of the locals.

In 1980 is the first efforts of the Ecuadorian government under the presidency of Ecuador to bring together those municipalities and the national institutions to sit at a table and try to convey, try to agree on, what was the development that Galapagos would need for the future. But it was just about almost 18 years after that that in many, many movements that were created in order to have a special law for the Galapagos Islands. The islands, fragile and unique, required a different legislation than the rest of the country. But in order to have a special law, the constitution of the country needed to be changed because one of the articles, I think it’s 258 if I’m not wrong, said that any Ecuadorian could move freely and live freely in any part of Ecuador. And then the addition was except the Galapagos Islands. And when that took place, then the special law could have been formulated. And then with that first exercise that took years of discussions, it was pretty much finalized in 1998, restrictions to mobility and some other activities and reinforcement of conservation were put into place. To implement that has been a long journey.
So since 1998 until 2021, the sustainable development, the word sustainability, had been advancing as the time went by. And it is in 2015 where the Galapagos Sustainable Development and Good Living Plan picked up the term strongly, but it was too short of a plan. So the current one of 2021 had inserted into its planning the United Nations Sustainable Development Goals that are inserted there and they are being used for the implementation of the plan.

So now we go a bit into the deeper concepts of sustainability and how they have evolved throughout time. And it’s important to notice that Galapagos is seen as a social-ecological system. It’s in the words of the authorities, in the words of most of the planners nowadays, it came up during the 2006 management plan of the Galapagos National Park and it has been reinforced in the 2014 management plan for the protected areas of Galapagos. So we have the social system and the natural capital, both of them interacting with human actions on the natural capital that provides the ecosystem services or ecological services. But they are, of course, subject to boosters of change, indirect and direct. The direct are the local, national, and international associated pretty much with the activities that the actors of the system takes place, and of course they change and the impacts on the natural system. And this concept of a social ecosystem for Galapagos that comes mainly from the planning exercises for the national park area also recommends that the inhabited islands work as a network. They should not be isolated or work on their own. They still tend to do that because they are independent local governments. So they have their own rules, they have their own council. Even though there’s directions for the province, they sometimes just take their own actions. So the collaboration is important.

So we’re gonna go through the threats and challenges. There’s many, but summarizing them: Galapagos has an annual population increase of 3.5 percent. It was more, but it was reduced with the law and took a bit of time. There’s an increase of introduced species. As we speak, the threats are there. There’s over 800 species of invasive plants. The last one and the complicated one is the Philornis fly, it’s affecting the population of more than 15 land species of birds. Pressure from fisheries—they want more species, more amounts. Most of the artisanal fishing has been coastal and the species like lobsters, newly-fished sea cucumbers, groupers, and these other coastal species are going in decline and they are asking for deep-sea fishing now. A pressure to increase tour operators and visitor sites and an exponential growth of tourism has been happening since the 1960s, the late sixties where the organized tourism in Galapagos started.

And with that increment of tourists along the time, poor urban and rural planning struck the islands. The cities have grown tremendously, no planning, or the planning is there but not really the capacity to follow the plans and the rules. And the public services have paid its toll too. Public services like potable water, hospitals, education, sewage systems are very, very precarious on the islands and the municipalities cannot cope with this alarming exponential growth of tourism and of course, local population. There’s poor funding for science and conservation, even though there’s more funding for science and conservation than for urban development and environmental aspects. Still, the funding for the maintenance of the natural capital is very poor. And the other threats and challenges, of course, are related with climate change and pollution that is not only coming from the islands themselves, but from many parts of the world as well.

So with these threats and challenges, a question came up in 2012 by the then-president of Ecuador: How many people can Galapagos hold? Not only tourists, but also residents there, and pretty much based on the studies that had been carried out in the past modeling on various islands, particularly in Europe, Greece, Spain, on tourism there. Then the study came on board. I was director of the, recently appointed as, director of the Galapagos National Park for the second time and the minister by then told me, “This is what the president wants, so you take
it on board, all right?” So leadership and political support it was there, the leadership by the Ministry of Environment with the Galapagos National Park Directorate and straight political support from up on top. It required interinstitutional cooperation from all the institutions in Galapagos and outside Galapagos with a multi, interdisciplinary team of scientists from the natural and social scientists, mathematics, statistical people. And I managed to get a team and the support from WWF, the World Wildlife Fund, from the University of San Francisco de Quito and North Carolina University of Chapel Hill, University of Cuenca, and many other institutions—CDF, Charles Darwin Foundation. Because we required lots of information in that and we managed to get data from 30 years on the most, you name it, sewage, population growth, health, labor, transportation, energy consumption, and so on and so forth, introduced species, ecosystems, information, etc. So the team used a systems thinking approach to develop scenarios, modeling on what are those scenarios that could be shown and help for sustainability and also identifying limits that it was called a point of no return, identifying those points of no return.

So we needed to find out the current situation of the islands with all that information. And then we can see in this diagram, the yellow curve is the tourists since 1972, that was until 2010 the information we gathered, the study was carried out in 2013. I managed to update a little bit with 275,000 tourists in 2018. And that curve of tourists, the yellow one, really behaves similar to the one related with the local population there. So they go almost parallel. And of course, that increase also relates to the increase of invasive species, which is the red line—I’m color-blind but I think I’m reading it correctly—is that green? Light green, light green, okay, thank you very much. So the light green for those that are watching this live streaming is the green one, and then, of course, the other small one, but very pronounced one, is the demand for energy, in this case fossil fuels, in that period of time.

Another of the interesting findings was the information about the number of tourists and where they were going to. And since 2009, we found out that Galapagos was receiving more tourists that were using the towns as the base to develop their activities than the usual model, which is, and still is, just getting your package, getting your tour on a floating hotel, on a boat, and visiting town only one of the towns, once a week. So since 2019, locally based tourism started growing, and even nowadays this is the tendency. So there has been a stable number here, but increasing it, can you imagine then this one putting the pressure on the municipalities and the growth is continuing.

So with this then in the middle of the diagram, for those that are watching us live, the very close relationship is between the tourists and local residents. The more tourists, the more local residents, the more pressure, the more need for provisional services are there. So with all the information that we gathered of 30 years, there was a hard work of the team to identify those variables for sustainability that had the most robust information throughout the years that could be placed into the modeling system, working, trying to adjust gaps of information using mathematics and algorithms and so on. So we identify these as the main ones and of course, if you have a look at any of these, they would be within the social realm of the system, of the social-ecological system, or it would be within the natural realm of the social-ecological system.

So with all that vital information and identifying those indicators, then the complexity of finding the relationship between them and what effect each of those would have on the other one, work on the causal loops of the modeling and this is just a tiny bit, I’m not going to explain the whole thing, this is just to show you the complexity of the work that the team and the institutions had to deal with. So with all that info and the link between those elements, three scenarios were proposed in order to show the dynamics of the social-ecological system of Galapagos. And
those three scenarios are linked with exponential growth of tourists or tourism, which is the first one here. The one that goes—can you help me with the color? It’s red. Thank you. For those out there, the red color—so the red color shows the exponential and actually, it’s the tendency that is happening nowadays. We did have the break of 2019, the COVID 2019, in 2020, but we are back again into reaching the same amount where it was left out before COVID-19. So it’s an exponential growth. Then the other scenario is what about if we moderate the influx of tourists to a 3.8 percent annually because this one was going at six percent and in some years were 11, 12 percent—a tremendous growth. And the other one is just stabilizing the number of tourists when the study started. So have the projections there at that pace by 2032, 20 years later, we would have business as usual, 900,000 tourists. Then reducing the influx would be over 300,000 and just around 200,000 if stabilization would have taken place. Now, we knew that the curves with the local population are similar. So there you go, the similar behavior of the curves with a projection of population growth at the pace of geometrical growth of tourism, we could reach in 2032 just about 110,000 inhabitants. Then the other one, the intermediate one, would probably reach just over 40,000 inhabitants and the other one just over 30,000, reaching 40,000 as a normal birth rate if the tourism growth is just stabilized.

Now of 100 and more parameters studied, I’m going to show you just a few of them and what is the impact of the different three-year scenarios on some of these parameters? So what is the impact of geometric growth and moderate growth of tourism and a stabilization model into these ones right here, into these parameters. So the land occupancy, when we go to the first one, land occupancy at the time of the study, by 2022 we would have reached 100 percent of land occupancy on the islands. And even though we had the break of COVID-2019, I think we’re probably almost reaching that stage now. And with the moderate, just visualizing reaching that 90 percent in 2033. When we go into saturation of visitor sites, by the time of the study and being a director of the national park, I knew that we had just reached some of the visitor sites near the towns already to be in a saturated stage. So this is what the projections of the study shows: by 2017 we’ve reached already and by 2020, in fact, as we speak, the Galapagos National Park is already working on the extension of more current and/or more visitor sites near the towns because the overwhelming arrival of tourists to the sites is impressive.

The reaching ecological point of no return, which is related to the invasive species altering the natural ecosystems in the geometric growth, I mean more tourists, more influx of goods and services and we have the years there by 2026 if business as usual, nothing was done, reach some of them, particularly those ones related with ecosystems near or on inhabited islands, would reach the point of no return. And the last one, in the stabilization by 2033 if nothing is done in some of the inhabited islands. The other figures were related to the numbers of production of waste and energy that would be projected in the different areas.

So the recommendations of the study would be where the stabilization of number of tourists by 2017, I mean we’ve reached 270,000 tourists already; limiting the flight frequencies to the islands; and increase the entrance fee to the park. Limiting the flight frequencies until these days had not been considered, properly at least. Increase entrance fees, various studies have been made—a willingness to pay exercise, a couple of them, shows that tourists are eager to pay up to $360 to enter the park but if there are some investments in improving the services for those tourist activities. So the other order recommendation is investing in services like transport and better services at restaurants, hotels, internet and so on. Strict and improved quarantine capacities—the Galapagos Biosecurity Agency is struggling, struggling to really cope with the pressure of the cargo that arrives to the islands. The dock in Guayaquil, we’ve been fighting 30 years, now there is money coming in for conservation, and there’s still no political decision to build the
dock for the Galapagos, which has already a property just about six years ago, with the proper infrastructure for a proper inspection of all the goods that are put on the ships that are going to the Galapagos Islands. Improve the budget for the Galapagos National Park Directorate. The marine reserve is very extensive, now there’s another area that has put on the shoulders of the Galapagos National Park Directorate, is that the Marine Reserve Hermandad, Brotherhood, that connects with the marine reserve of Cocos Island up in the north in Costa Rica. Science and education: we talked about that and the need to reinforce the funding to generate information for the social-ecological systems. Capacities of municipalities to really implement and plan and have a good direction of how the cities or the small towns cope with the increase of tourism and provide the good services, education, health, electricity to the local people. Reduce the use of fossil fuels and improve mobility, and another recommendation is generate capacity to assess and monitor the behavior of Galapagos. This exercise here did leave behind the tool and the exercise where the institutions were to contribute, to raise the information, to accumulate the data that could be put into this system and have an opportunity to show the decisionmakers the best ways to go on the sustainability of Galapagos.

And last but not least, the community needs to be informed and the community needs to be participating strongly in the decisions because the top-down approach has mainly been part of the development of Galapagos. You know, taking advantage of democracy you are elected and they do what they like, but the spaces for participation, they are very poor. They are just starting and this is something that I will show that to you.

So my own reading about the situation is that sustainable development or sustainability is unstable. You know, those three pillars are not the same size. The economic development, the interests of tourism are dominating, you know, stumbling the environmental protection leaving as the second one where the concept is being put attention to, but the social aspect of Galapagos is being left behind. I know that it’s important to fight for the environment because it’s what supports all living human livings on the islands, but the social development is very poor and needs attention. Not to say the governance, which is required as an element of sustainability, every two years we have elections, so every four years president and congresspeople and every intermediate years we have elections of city councils and mayors.

So, some evidence that we have made some progress: the social-ecological system concept has been inserted into the regional planning and the regional planning had already inserted the United Nations Development Goals and the current plan has five axes, which is Governance, Habitat, Economy, Community, and Environment. And lately, as well, in order to help support the importance of implementing the plan and the SDGs, Galapagos Hub was created and approved by the Galapagos Government Council where an external group of universities and research institutions would provide with support on sustainability, innovation, and resilience. And hopefully we can call on the attention of Stanford with the new School for Sustainability to consider being part of this Galapagos Hub.

Now, the participation of the communities is incipient, but there are spaces out there it needs to be reinforced, it’s happening, but it requires much more political decision but also requires the push from the bottom, from the local, either citizens or groups in the community, but they have a place in the Galapagos Planning Assembly. They have also participated in identifying the milestone and indicators that are in the implementation of the plan for Galapagos 2030. And recently as well funded by the international community, European Union particularly, there are some interesting projects that are being held and developed at the moment with the initiatives that depart from the community. [And I make a parenthesis here: Wednesday next week, my class will be listening directly from Galapagos, the key actors that are involved in this last effort.]
So, a few recommendations after COVID-2019. We need to diversify the economy of the islands for better resilience. Putting the eggs in just one basket, like tourism, we’re going to suffer if another of these external factors like a pandemic strikes us again. We need to articulate land-based tourism, the ones that arrive to the towns, with the ones that are regulated by the national park. Those two models need to get closer together if we are to diminish the pressure on the ecosystems and the social systems, too. The municipalities, they need to work together, they must get together. Even though they do it at the Galapagos Government Council, they tend to take individual actions, and there’s lots of opportunities if they would work together.

Not to let business as usual take over again. We shouldn’t go back to what it was before 2019. We need to act, we need to be innovative, and we need to be persistent in having different ways in order to achieve sustainability. And last but not least, reinforce the community participation and decision-making based on scientific and technical information, which is out there. We’ve shown that this study comes from 2013–2014 and very little has been done. So there is a need to push that from the bottom up and use the scientific and technical information.