

# Environmental Conservation Fact Sheets and Activities Workbook

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Buschman

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

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# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

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This section is far from inclusive. There are so many other individuals that deserve recognition for my success in this experience.

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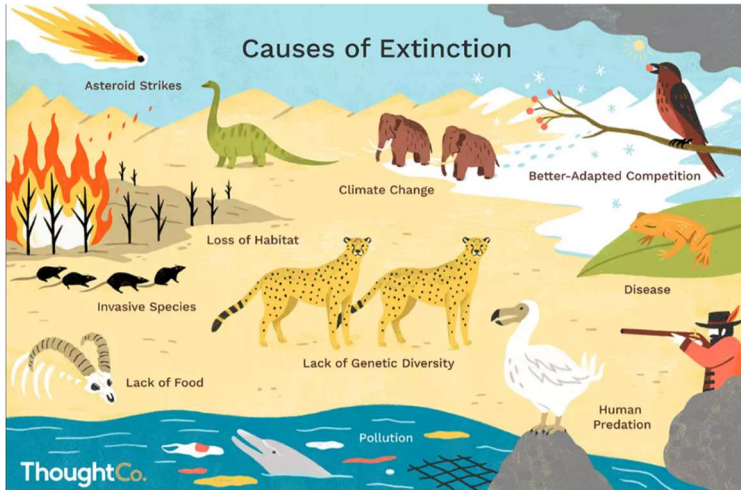


Figure 1: Image of Causes of Extinction courtesy of Thoughtco.com

## INTRODUCTION

The book provides a hands-on practical learning experience for children and young people in the conservation field. The publication utilizes a combination of fact sheets and activities to teach and engrain a diverse set of topics in the conservation field. The young target audience is because that age group is educationally pragmatic and has a long time horizon to impact change. Conservation is a

fundamental science topic because of the growing

imminency of the threats based upon poor stewardship and its current impact on the world's animal species, the natural environment, and the human population.

The current devastation to the environment cannot be overstated. For instance, according to the 2018 IUCNredlist assessment, 28% are currently threatened, 42,000 of the 150,000 species assessed in the study.

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

Among these threatened species, nine thousand animal species are currently considered critically endangered.

SPECIES PERCENTAGE IN GROUP CURRENTLY THREATENED WITH EXTINCTION ON IUCNREPLIST.ORG

AMPHIBIANS	MAMMALS	CONIFERS	BIRDS	SHARKS & RAYS	REEF CORALS	SELECTED CRUSTACEANS	REPTILES	CYCADS
41%	27%	34%	13%	37%	36%	28%	21%	69%

Habitat loss, climate change, and the loss of animal biodiversity are illustrations of the extreme pressures on animal populations. These threats result in between 20 and 200 species extinctions per year. Poor environmental stewardship by humans is the direct cause of many of these extinctions. Scientific research estimates that humans are responsible for up to 99% of global extinction. Further, most other species of animals have already experienced significant population decline and species richness loss and their habitats are under pressure from anthropogenic change. Habitat loss on land has resulted in the eradication of 570 plant species in the last 20 years. Meanwhile, habit degradation in the sea has resulted in ecological dynamic shifts in 66% of the surveyed habitats. Many of the world's pollinator species are also threatened, increasing the threats to the remaining habitats. This includes most bee species.

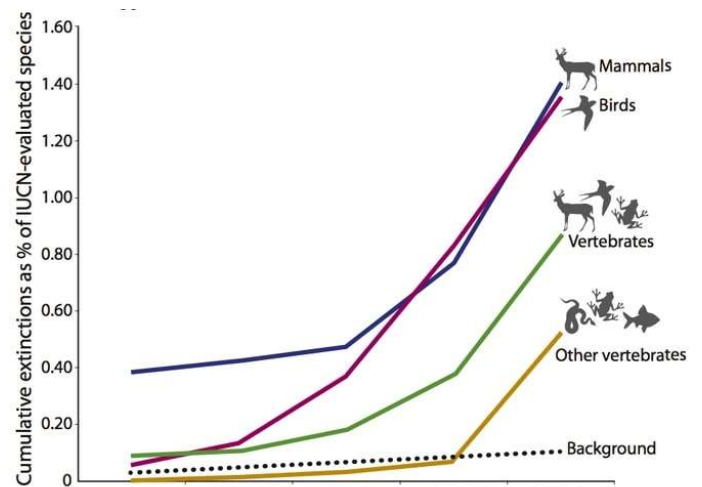


Figure 2: Extinctions on the rise Graphic provided by Earth.org

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The future of the world's wildlife is more dire than the current plight. The current extinction rate is between 1,000 and 10,000 times the natural rate. Five global extinction events (characterized by the loss of

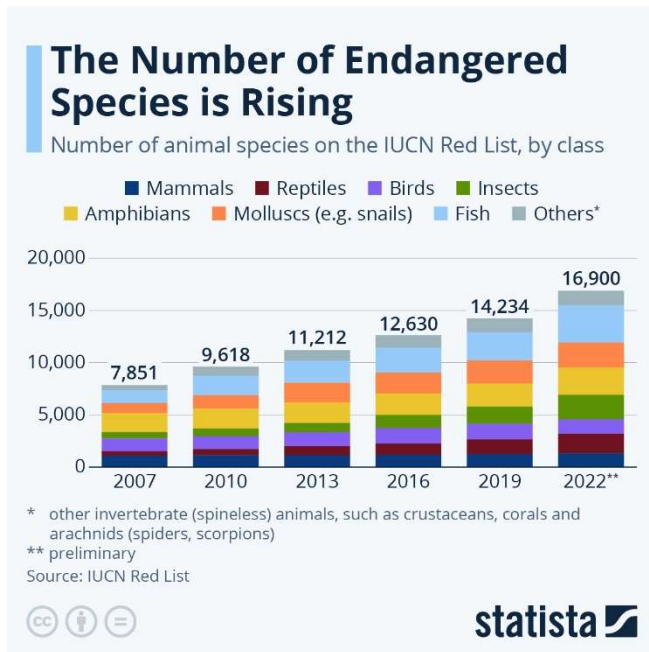


Figure 3: In the latest version of IUCN updates for 2020, more than 15,400 animals were listed as threatened – almost double the number in 2007.

Image by Statista.

<https://www.statista.com/chart/17122/number-of-threatened-species-red-list/>

50% loss of all plant and animal species) have happened in world history; scientists worry that we are in the midst of the sixth event. Mammals are especially prone to be driven increasingly being driven into extinction. One out of 4 mammals are currently being threatened and many flagship species are threatened. These threatened flagship species include tigers, snow panthers, cheetahs, polar bears, eastern gorillas, red wolves, and elephants. In the water, 6 out of the great 13 whale species are threatened.

There is reason for hope, however, as there have been numerous successful conservation examples. These examples include many flagship species that can serve as template species for those that are threatened. For instance, the bald eagle, grizzly bear, and panda have all

recently experienced population resurgences; however, the time to act is now.

The importance of general public's exposure has grown exponentially as the imminency of the the issues has increased. People are forced to cope with the impacts of climate change and environmental degradation in their everyday life; it is no longer an abstract issue for the future it is impacting children's ability to thrive and even survive. In Latin America, climate change is causing serious damage to food, water, and socioeconomic security.

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

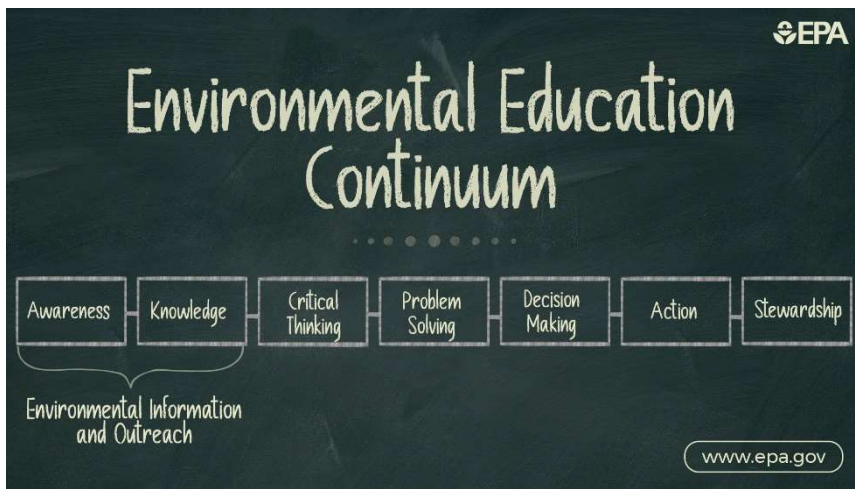


Figure 4: Environmental Education Graphic Provided by the EPA.gov

Children are critical conservation education targets because they are powerful agents of change. They have the longest time horizon for impacting change and are most willing to adjust their viewpoint on a core issue. The outcomes of conservation education can be enhanced by focusing on local issues in a team setting. These facts make it crucial

to expose them to a breadth of conservation issues throughout their lives and teach them to engage critically with the issues. Good environmental education transcends the classroom and results in empowered teachers and students! This activity book hopes to help fill this niche by providing background to educators through its depth in variety and hands-on activities. This book is designed to provide multiple fact sheets in diverse areas to educate children and young adults on a breadth of environmental conservation issues. The young target audience and practical education experience, with activities, of this book, should help aid it in creating its largest possible impact on the conservation movement.



# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Section 1: Conservation Bioacoustics

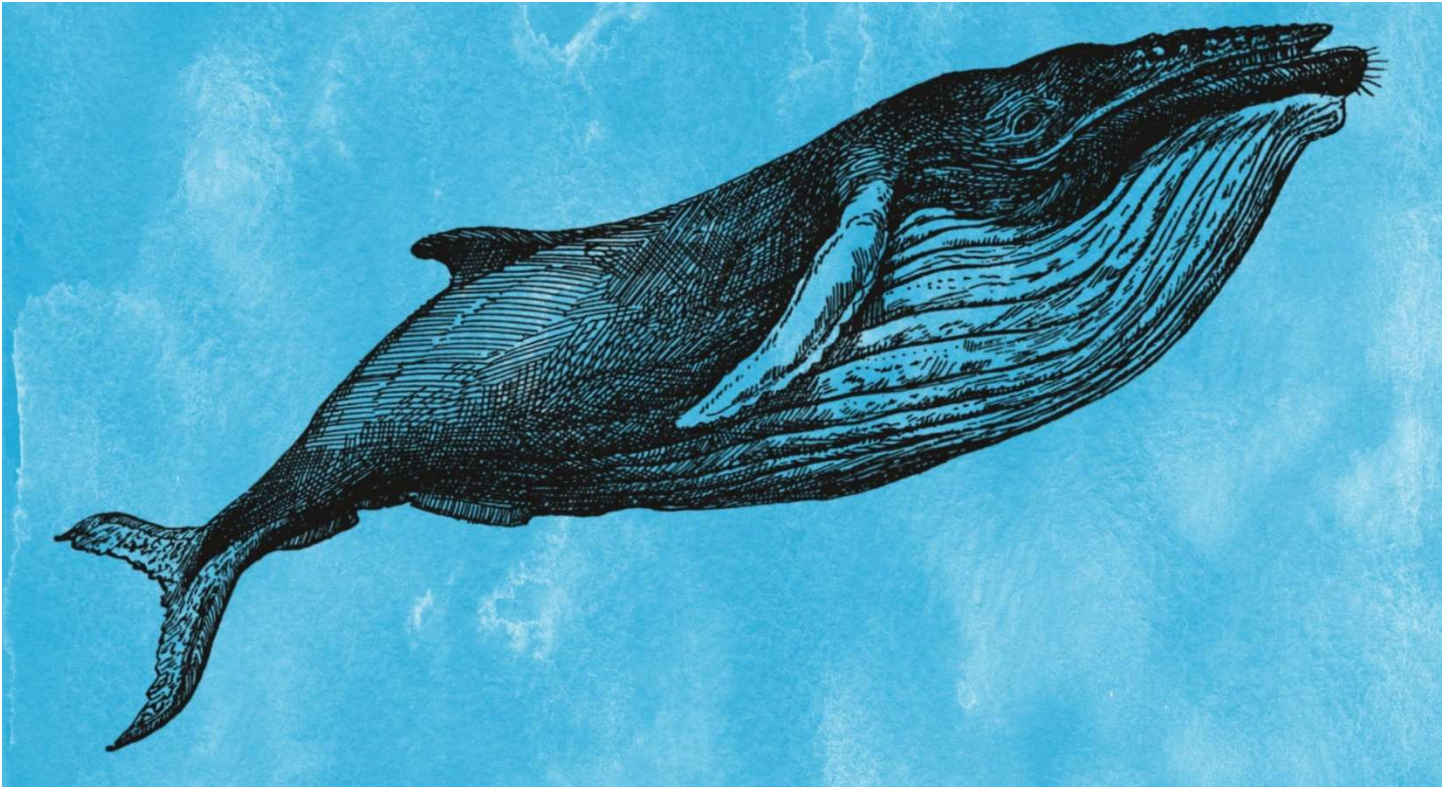


FIGURE 5: IMAGE COURTESY OF PUBLICDOMAINIMAGES.NET

### Conservation Bioacoustics – What Is It?

Conservation is the initiative to safeguard the Earth's resources for current and future generations.

Bioacoustics is a scientific subfield concerned with sound production and its effects on living organisms.

### Combined

Conservation Bioacoustics is the interdisciplinary study of sounds for understanding and protecting species and ecosystems. It is a combination of science, policy,

The study of bioacoustics includes monitoring:

- Animal sounds
- Animal communication
- Bio sonar
- The anatomical underpinnings of sound production and auditory perception
- Animal neurophysiology and cognition
- Animal phylogeny
- Acoustic ecology
- Animal Behavioral responses
- Passive acoustic tools and methods



# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

economics, and society and involves the study of sound production, reception, and communication in living organisms, particularly animals.

Bioacoustics can be instrumental in many parts of the conservation process but needs to be accessible to the many stakeholders in the process. These stakeholders include politicians, government agencies and their employees, institutions of higher learning, students, non-profits, conservationists, and the public. The party's buy-in requires education on the conservation bioacoustics process and its complexities. Further, conservation bioacoustics is a nascent field. Human-generated noises are a recent phenomenon. Most anthropogenic sounds have been impacting the seas for only about the last 100 years. Before that marine sound landscapes remained relatively naturally pristine. Today's oceans are 10x as noisy as they were 50 years ago due to human-caused sounds. The complex interactions of this anthropogenic noise and marine habitats are widespread but they are still not well understood. These realities make it a pivotal conservation issue and a burgeoning potential career field.

Conservation bioacoustics has a potential impact during the monitoring phase of the conservation process. During this phase bioacoustics can assess biodiversity, determine conservation priorities, and observe population changes. Bioacoustics can also be vital for the assessment and planning phase of the effort. Its impacts during this phase include determining conservation effort shortfalls, planning novel solutions, and implementing the solutions. Aspects of these planning decisions including species management, habitat management, and regulation enforcement can also be informed by the soundscape.

## Conservation Bioacoustics – Basic Terminology



FIGURE 6: IMAGE COURTESY OF  
FREEVINTAGEILLUSTRATIONS.COM

- **Acoustic Space Use (ASU)** – An index of sound that measures the frequency and time of sounds in a soundscape. Some studies have shown this index to be positively related to species richness such that sites with higher ASU values have more species.
- **Anthrophony** – Sounds produced by human activity, directly or by our technology in a soundscape. These include:
  - Human voice
  - Construction
  - Automobiles
  - Drilling
- **Attenuation** – The gradual reduction in signal strength as it travels through a medium. The loss in signal strength results from a loss in energy.
- **Biophony** – All sounds produced by animals in a soundscape.
- **Detectability** - The probability of detecting a species in a habitat. This variable is influenced by many factors including researcher skill level, technology used, habitat dynamics sampling method and effort.

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

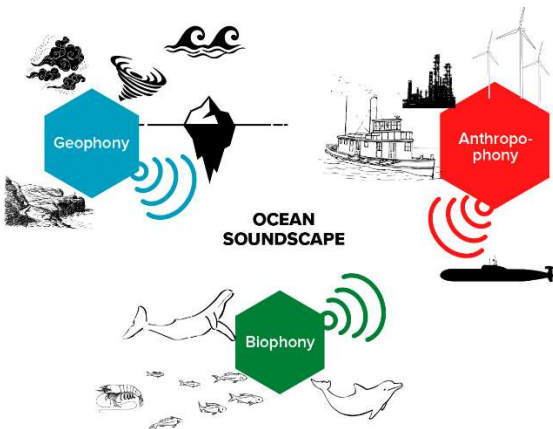


FIGURE 7: IMAGE VIA NOAA.GOV

- Detection range (of an acoustic receiver): The distance at which a recorder can reliably detect a given species' target sound. This can vary by environment.
- False Positive - The detection of a species when it is not present; statistically a type I error in hypothesis testing.
- False Negative - The failure to detect a species when it is present in the area; statistically a type II error in hypothesis testing.
- Geophony – The sounds produced by the geography of a soundscape. These include wind, waterfall, and other water movement among many others.
- Machine learning - A domain of computer science focused on automating data analysis. Algorithms predict class labels based on an available training dataset. In bioacoustics, this training data may consist of a species-specific sound in a habitat.
  - Supervised machine learning: The models and algorithms are tuned to determine relevant inputs using human-defined target classes.
  - Unsupervised machine learning: The algorithm learns patterns without being given explicit target outputs (i.e., labels/classes). The human is not necessary to the process because the computer defines the classes too.
- Noise- All sounds in a soundscape except the signal of interest (e.g., wind, machines, etc.)
- Passive acoustic monitoring- A conservation technology method to survey and monitor wildlife and ecosystems using autonomous acoustic recorders deployed in the field. It allows ecologists to monitor and assess habitats without direct observation.
- Signal-to-Noise ratio (SNR) - A measure of the ratio between the strength of a signal and the strength of background noise present. The higher the ratio the better the signal quality.
- Species richness- the number of species in a habitat. The species' richness can be measured by sampling or census. It is a simple metric but can be useful in obtaining the biological complexity of a habitat.
- Soundscape- The sounds at a habitat during a specific period. These sounds are composed of three fundamental sources: the bio phony (animal sounds), the geophony (geophysical sounds), and the anthropony (human sounds).

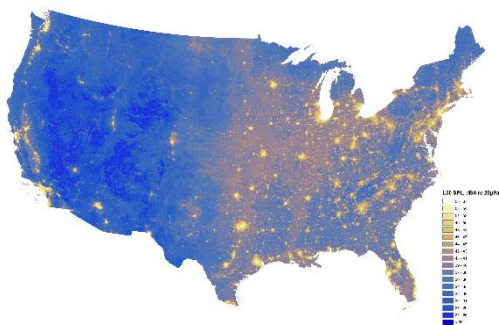
# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Conservation Bioacoustics – Why is it Important?

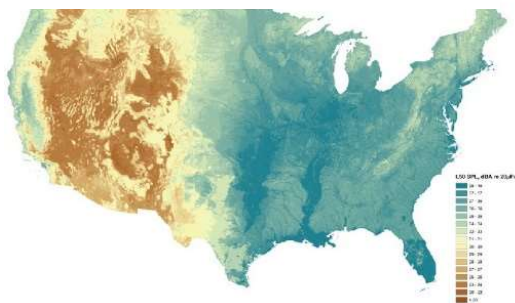
Conservation bioacoustics informs the broader conservation movements to protect endangered species and habitats. Passive acoustic monitoring is especially effective because it doesn't require direct animal population monitoring. Direct observation can be impossible with many cryptic endangered species and difficult/cost ineffective for others.

Moreover, Passive Acoustic Monitoring (PAM) provides many important insights for conservation that might be missed otherwise. First, it provides a multifaceted persuasive record of a soundscape. The recordings may include environmental sounds, anthropogenic activity, and multiple target species. Further, it is noninvasive for the habitat and is especially effective for vocally active, visually hidden species. These species may be nocturnal or hiding from predators.

It can also be utilized in array of diverse applications. The possible conservation activities of biacoustical analysis include:



**FIGURE 8: IMAGE OF CURRENT UNITED STATES  
SOUNDSCAPE VIA NPS.GOV**



**FIGURE 9: IMAGE OF PRISTINE USA SOUNDSCAPE  
VIA NPS.GOV**

1. Species and habitat evaluations to monitor trends and address direct observations data gaps
2. Biodiversity inventories
3. Anthropogenic habitat impact assessment
  - a. Windfarms
  - b. Solarfarms
  - c. Off shore drilling
  - d. Traffic/boat activities
4. Fish/poaching regulations effectiveness
5. Evolutionary insights into species behavior.
6. Habitat restoration effectiveness.

Additionally conservation bioacoustics plays a more direct role in preserving natural soundscapes. The sea has experienced percipitous noise pollution in the last 100 years as industrialization has taken hold. There are few available areas that have not been impacted by this noise. In fact, scientist estimate that anthropogrenic activity significantly impacts 66% of marine environments. These impacts have forced ecological dynamics in these habitats to shift and led to population size decreases and species diversity loss.

Importantly, passive acoustical monitoring can provide insight into these shifts in population in a cost effective manner because it doesn't require costly direct species observation. Further, it can be used across a diverse range of species and

habitats.

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Conservation Bioacoustics – Impacts So Far:

The United States was an early mover in the conservation movement. Noise pollution is pretty much ubiquitous across the United States. It is even widespread in governmentally protected areas. The majority of the research has taken place in a terrestrial setting but much of the advanced technology is featured in the marine studies. Through 2015, there had been about three times as many marine studies as terrestrial studies. Many scientists attribute this mismatch to the Marine Mammal Act of 1973. It led to significant naval financial investment in the marine technology setting to comply with its terms.

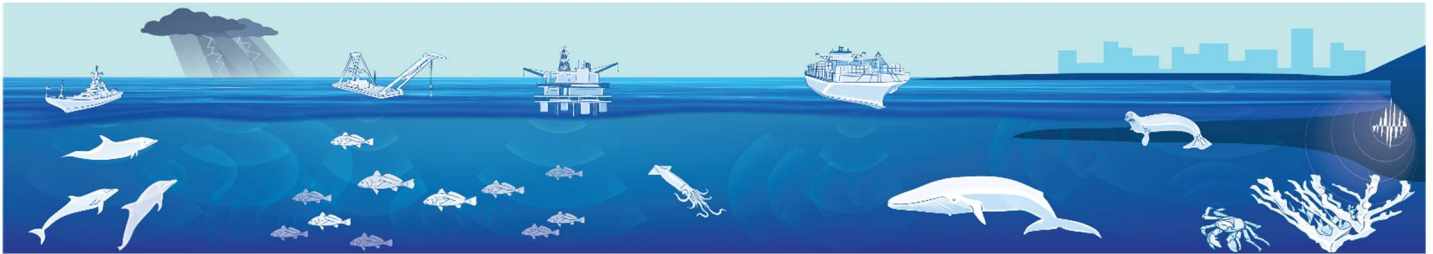


FIGURE 10: IMAGE OF MANAGED SOUNDSCAPE VIA THE OCEANOGRAPHIC SOCIETY AND CREATIVE COMMONS

License link: <https://creativecommons.org/licenses/by/4.0/>

## Conservation Bioacoustics-Impacts

It is critical to measure the effects of conservation bioacoustics efforts in a tangible scientific manner. These tangible achievements are considered direct outputs of the conservation effort and include datasets, publications, and websites. The accomplishments also need to be evidenced to create plans for intelligent further action. They can help to reveal the characteristics of pristine soundscapes and expose the processes in the Anthropocene that have altered them.

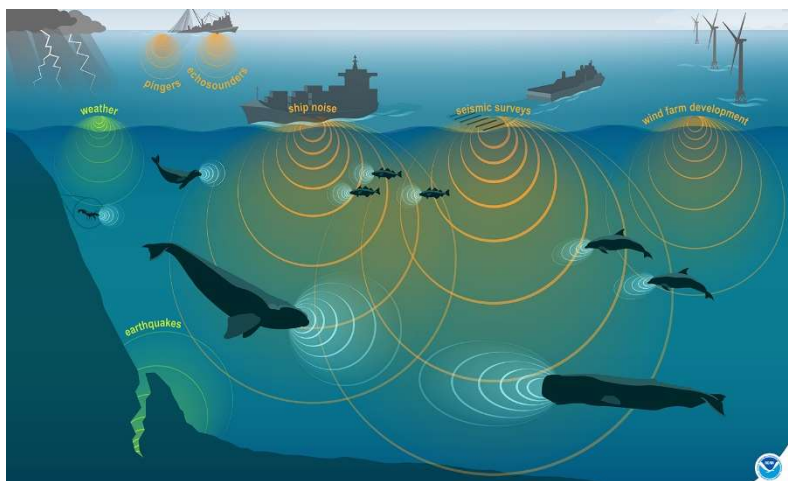


FIGURE 11: IMAGE OF THE ANTHROPOCENE LANDSCAPE VIA NOAA.GOV

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

Further, research efforts often have a broader impact that must be considered in a full analysis. These distal impacts include further legislation, broader public awareness, and enhanced media coverage. These impacts can be more difficult to monitor because they are more tangential to the research, however, they are directly connected to our goal of a well-managed world soundscape. Thus, it is imperative to transition research outputs into societal outcomes. Importantly, this transition will result in the generation of many jobs.

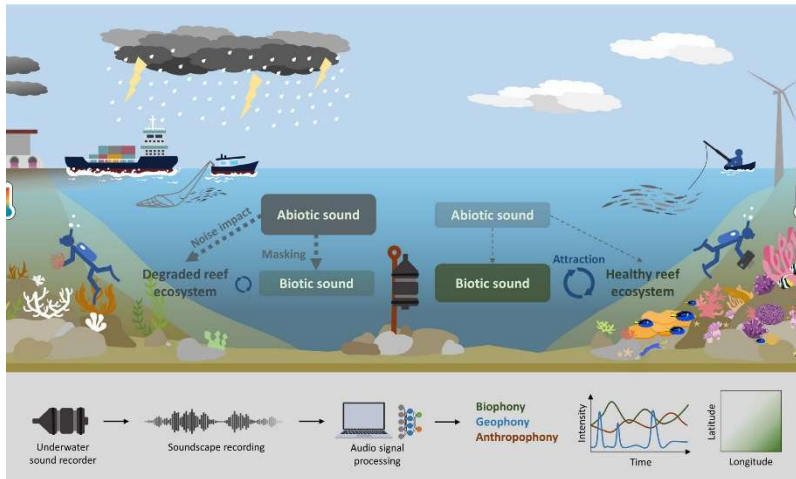


FIGURE 12: IMAGE OF A WELL-MANAGED SOUNDSCAPE VIA THE OCEANOGRAPHY SOCIETY AND CREATIVE COMMONS

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## Conservation Bioacoustics- Careers

Conservation Bioacoustics is a growing interdisciplinary field that can provide careers in many related areas. The connected scientific areas include:

- Scientific Research – The field has only started to open into the innumerable applications available to it. Thus, there is a burgeoning opportunity for scientific research and education in the bioacoustics field.
- Policy – Informed Policymakers are needed to properly shape regulations. This requires basic knowledge and background in the conservation bioacoustics movement. The more education these legislators have, the better it is for our environmental future!
- Academia – Conservation bioacoustics insights will need to be shared with all the stakeholders. This comprehensive educational endeavor requires informed post-secondary educators to lead the education efforts.
- Federal and State Agencies- Government agencies and their employees need to be able to assess relevant research and legislation and use it to inform conservation regulations.
- Non-profits- Non-profits are pivotal in driving conservation efforts. They also help to educate the public about ecologically relevant research. It is critical that they provide the public, policymakers, and stakeholders with precise assessments about the research and movement urgency.
- Private Sector- The government has driven early conservation bioacoustics efforts; however, private sector businesses are gaining vested interests in understanding conservation bioacoustics. This has been especially evident as their operations are impacted by conservation regulations driven by bioacoustics.



# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Conservation Bioacoustics – The technology

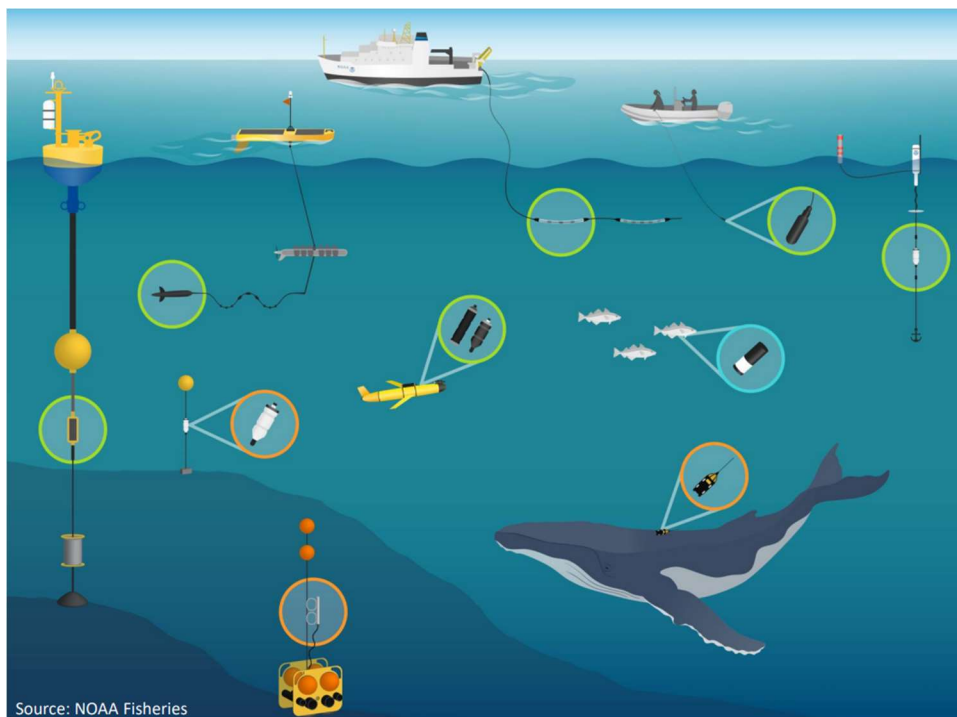
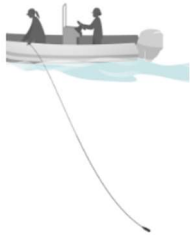


FIGURE 13: IMAGE OF MARINE RECORDING DEVICES VIA NOAA.GOV

### In The Ocean:



**Dipping Hydrophone:** A dipping hydrophone is an underwater sound device that measures sounds from all directions. It is usually attached to a fixed point (land) or a moving point (boat) above water. The hydrophone

is the simplest approach to underwater passive acoustic monitoring.



# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES



**Bottom-mounted recorder:** Station underwater passive acoustic monitoring device fixed to a particular seafloor location. The bottom-mounted recorders are useful for collecting long-term sound data with vocally active species.

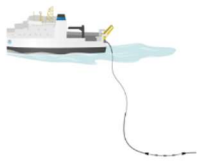


**Drifting buoys:** Slow-moving underwater passive acoustic monitoring device that is motivated by water currents. The recorded soundscape can be saved to a hard drive for later analysis or transmitted via iridium satellite for contemporary analysis. d



**Gliders (Floaters):** these underwater machines are self-propelled recording devices and move slowly through the water according to assigned trajectories. They can transmit recorded data in a real time manner. This is usually accomplished using iridium satellite or cellular networks. They are the most expensive underwater passive acoustic monitoring device. They can be instrumental in tracking the movements of migratory species.

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES



**Towed Arrays:** These PAM receivers are a dipping hydrophone mounted to a moving vehicle. They are towed horizontally behind the ship.



**Animal-borne tags:** These recording devices are attached directly to the target animal. They can yield important animal behavior insights.

## On The Land:



**Handheld Microphone/Recorder:** These simple recording devices are transported by the observer and can provide useful behavior insights because they are usually accompanied by user visual observations.



**Autonomous Recorder:** These recording units consist of a recording unit, battery, and protection against a habitat's environment. They are usually attached to a fixed point in the target soundscape and left there for a designated period. They are a crucial source for collecting terrestrial passive acoustic monitoring data.

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Conservation Bioacoustics – Fun Facts

l

1. The speed of sound in the sea is over 4x the speed of sound in the air.

- Land – ~340 m
- Water – ~1500 m



(about 1115.49 ft)/s

(about 4921.26 ft)/s

FIGURE 14: IMAGE PROVIDED COURTESY OF

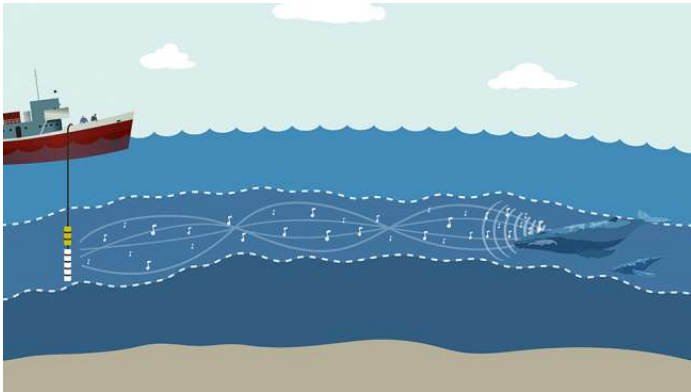


FIGURE 15: IMAGE OF SOFAR CHANNEL VIA NOAA.GOV

2. The depth of the sea known as the SOFAR (Sound Fixing and Ranging) Channel allows sounds to be transmitted thousands of meters without the signal losing significant energy. At around 1000m (about 3280.84 ft), acoustic sounds in sea reach the minimum thermocline speed. The oscillating of the waves around this depth allows sound to travel several thousand meters without the signal losing significant energy.

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Section II: Conservation Bioacoustics – Baleen Whales

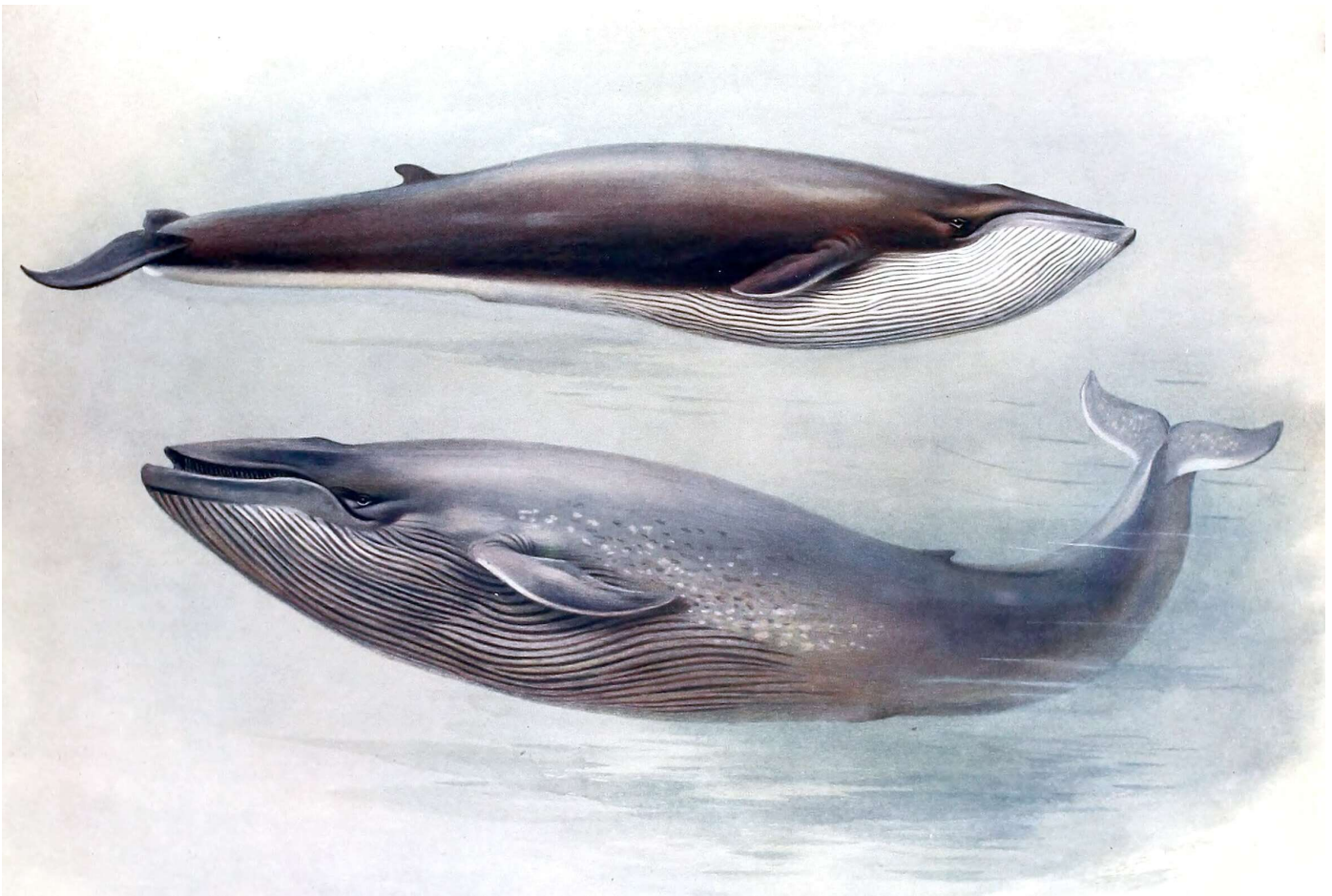


FIGURE 16: IMAGE OF BLUE WHALE PROVIDED BY FREE VINTAGE ILLUSTRATIONS WEBSITE.

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Baleen Whale – What Are They?

A **Baleen Whale** is a cetacean possessing unique epidermal modifications of the mouth described as baleen. The baleen is a small comb structure in their mouth. It allows the whales to filter large volumes of water and capture the prey in it. The baleen is also called a whalebone and is used primarily to filter plankton, krill, and other small fish. A cetacean is any marine mammal belonging to the order Cetacea. Collectively, they span three families across four genera and 14 species. Sea mammals are some of the largest animals on the planet, ranging from 10 meters to 30 meters in length.

The study of bioacoustics includes monitoring:

- Current and Historical Whaling
- Entanglement in fishing equipment
- Ship Strikes
- Health
- Other Anthropogenic Threats
  - Pollution
  - Climate change and acidification

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Baleen Whale – Conservation Importance

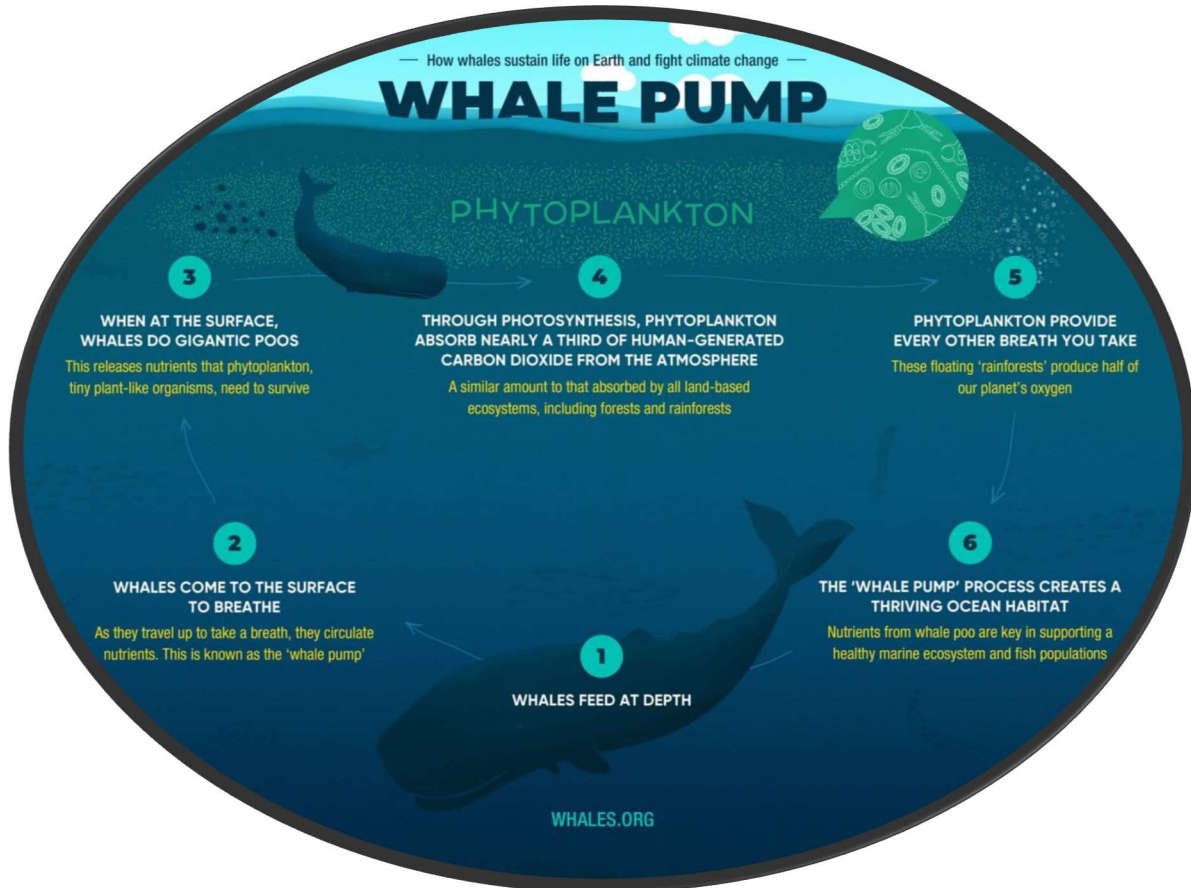


FIGURE 17: IMAGE OF WHALE PUMP PROVIDED BY WHALE.ORG



# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

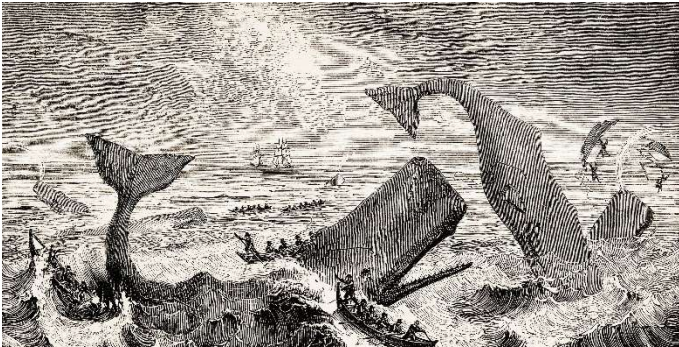


FIGURE 18: IMAGE OF WHALE HUNTING PROVIDED BY  
RAWPIXEL.COM

Baleen whale populations are currently in peril.

Recent research estimates show that great whale populations have fallen as much as 90% from their peak. There are fourteen species of Baleen Whales. Five of these species are endangered and there is insufficient data to evaluate the status of four more species. These highly intelligent, social creatures need humans to fulfill their roles as stewards of the earth.

The conservation of whales is complicated by their cryptic nature and low population levels. These characteristics make them difficult to directly observe, study, and protect in their natural world. Most species are

incredibly social and vocal within their pods, however, and provide ideal research subjects for conservation bioacoustics. They utilize their communications to share migratory, mating, hunting, social, and defense functions.

Whales are the largest animals to inhabit the earth since the dinosaur; baleen whales and sperm whales are especially large whale types and fulfill an equally significant role in our oceans as ecosystem engineers. Their long-life spans add an element of stability to a rapidly evolving ecosystem. They help to feed the phytoplankton of the ocean which are instrumental in maintaining a healthy carbon/oxygen balance in our world. The tenuous population status of Baleen Whales put added pressure on this already fragile equilibrium.



FIGURE 19: IMAGE VIA  
NOAA.GOV

## Baleen Whale – Vocalizations

Baleen Whales primarily utilize exceptionally low frequency (20-200Hz) moans, grunts, thumps, and knocks. These low-frequency vocalizations travel extraordinarily long distances in their ocean habitats. Secondly, the whales can also share information in an alternate frequency range. The higher frequency vocalizations may provide communication protection from eavesdropping and (>1000 Hz) consists of chirps, cries, whistles, and songs.

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Baleen Whale – (Mysticeti) Types

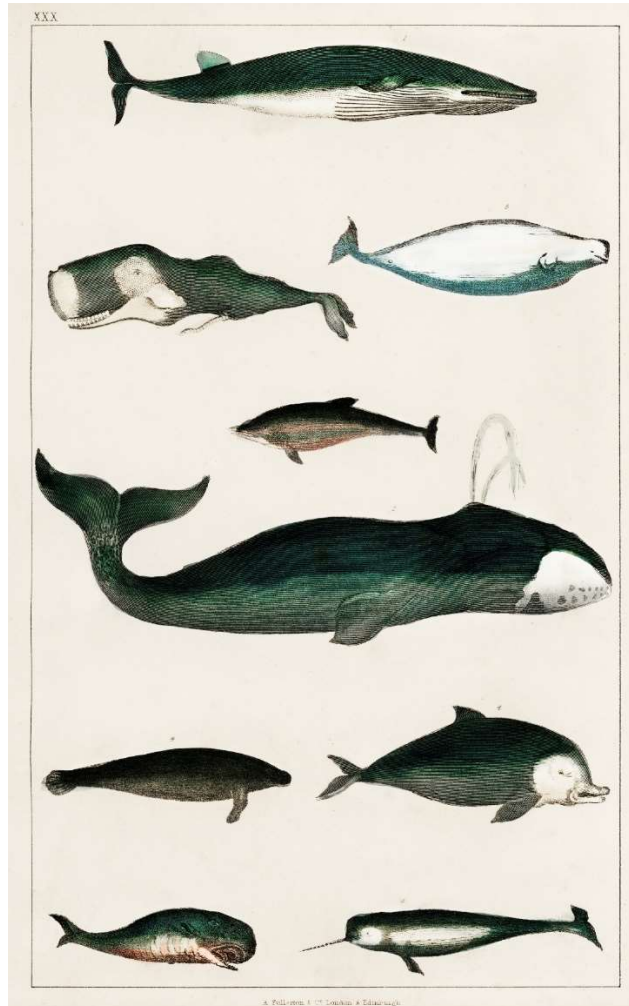


FIGURE 20: IMAGE OF BALEEN WHALES PROVIDED BY RAWPIXEL.COM

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Family (Balenidae)

This family consists of right whales and bowhead whales. The class of whales has rounded dorsal fins, a distinctive arch in their skulls, and stocky builds. Throughout history the four species that compose this group were highly valued by hunters for their blubber and meat. Their populations have rebounded recently in some habitats, but they are vulnerable to anthropogenic threats. They are especially susceptible to climate change, habitat destruction, noise pollution, and commercial fishing.



FIGURE 21: IMAGE OF BOWHEAD PROVIDED BY  
NOAA.GOV

Genus (Balaena) – The Bowhead whale is the thickest layer of blubber of any whale species at over twenty inches. This allows the whale species to live in both Arctic and subarctic waters. Their most characteristic feature is a massive head that can constitute almost a third of its body length. They can reach up to sixty feet in length and fifty-four tons!

Bowhead whale (*Balaena mysticetus*) – The 2018 IUCN assessment listed the Bowhead whale as a species of the least conservation concern. There are currently 10,000 adult individuals with an increasing population trend.

Current IUCN REDLIST species extinction threat level								
NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENGANGERED	EXTINCT IN WILD	EXTINCT

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

Genus (*Eubalaena*) – this group of whales is collectively known as right whales because they were prime targets for hunters. They moved slowly and floated after whalers killed them. These characteristics put them at risk for exploitation by the



**FIGURE 22: IMAGE OF NORTH ATLANTIC RIGHT WHALE PROVIDED BY NOAA.GOV**

whaling industry. They can reach up to sixty-six feet in length and eighty-two tons! The species share many similarities, and their ranges overlap but they do not interbreed leading to their classification as distinct species. All species have stocky bodies, with large, round heads. They have callosities and elevated bumps in place of dorsal fins on their head. They are mostly black or dark grey in appearance and are highly social/vocal animals. Their vocalizations include moans,

groans, and grunts. These lower-frequency vocalizations communicate age, sex, and reproductive status over long distances. They also utilize higher frequency communication, to obscure communications from predators.

**North Atlantic right whale** – The North Atlantic right whale was categorized as critically endangered in the 2020 IUCN assessment. There were only 409 individuals in the last completed survey and only 250 of these individuals were mature adults. The North Atlantic right whale is also experiencing a downward population trend. The population decline from 2011 -2020 was due to increased mortality rates due to entanglement with fishing gear and increased habitat competition with other whale species.

*Current IUCN REDLIST species extinction threat level*

NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENDANGERED	EXTINCT IN WILD	EXTINCT
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# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

North Pacific right whale

Southern right whale

Family (Balaenopteridae)

This whale family is also known as Rorqual whales. They are some of the largest whale species on earth, outstripping even most other baleen species in size. They also share other prototypical morphology within the family. They exhibit a sleeker form than other baleen whale species. This slender physical form results in them being more proficient swimmers than their cousins. They also have throat plates, which run the length of the whales and allow them to engulf copious volumes of food during feeding. The Rorqual whale family also exhibit behavioral peculiarities that link them as a group. They are highly social and have developed a complex communication system to facilitate their social interactions. They are also migratory in nature utilizing a mating habitat for part of the calendar year and traveling to a separate environment for their feeding grounds.



FIGURE 23: IMAGE OF BLUE WHALE PROVIDED BY NOAA.GOV

Antarctic minke whale (Balaenoptera

bonaerensis)- The Antarctic minke whale has 200000 mature individuals in the wild and an unknown population trend according to the IUCN Red List. It is a species of least concern.

Current IUCN REDLIST species extinction threat level

NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENGANGERED	EXTINCT IN WILD	EXTINCT
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Blue whale (Balaenoptera musculus) - The blue whale was the most valuable whale species to a burgeoning 19<sup>th</sup> century whaling industry. Hunters depleted these populations based on a demand for blubber during the whaling era. The whale species became protected by IWC regulations in 1955 but the inadequate enforcement of the international blue whale hunting moratorium has led to most subspecies' populations remaining under pressure and endangered. According to the 2018 IUCN red list assessment, the blue whale is listed as endangered but with increasing population trends due to conservation efforts!

Current IUCN REDLIST species extinction threat level

NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENGANGERED	EXTINCT IN WILD	EXTINCT
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# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

- Northern blue whale (*Balaenoptera musculus musculus*)
- Antarctic blue whale (*Balaenoptera musculus intermedia*)
- Northern Indian Ocean blue whale (*Balaenoptera musculus indica*)
- Pygmy blue whale (*Balaenoptera musculus breviceuda*)
- Eden's whale (*Balaenoptera edeni*)

Bryde's whale (*Balaenoptera brydei*)- data deficient but did not experience whaling pressures throughout history.

Current IUCN REDLIST species extinction threat level								
NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENGANGERED	EXTINCT IN WILD	EXTINCT

Fin whale (*Balaenoptera physalus*) – Fin whales were listed as vulnerable as part of the IUCN assessment but have experienced a healthy trend toward population recovery since gaining protection from commercial whaling.

Current IUCN REDLIST species extinction threat level								
NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENGANGERED	EXTINCT IN WILD	EXTINCT

Dwarf minke whale (*Balaenoptera acutorostrata*)

Omura's whale (*Balaenoptera omurai*) – IUCN was unable to procure sufficient information on Omura's whale to accurately assess its level of endangerment during the 2018 assessment.

Current IUCN REDLIST species extinction threat level								
NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENGANGERED	EXTINCT IN WILD	EXTINCT

Rice's whale (*Balaenoptera ricei*)- Rice's whale was listed as critically endangered in the 2018 IUCN assessment with declining population trends. There has been significant range, genetic diversity, and overall population contraction during the last 150 years. The 2018 population survey estimated fifty-one individual whales with only twenty-six individuals that were sexually mature.

Current IUCN REDLIST species extinction threat level								
NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENGANGERED	EXTINCT IN WILD	EXTINCT

Sei whale (*Balaenoptera boreali*) - The Sei whale was listed as endangered on the 2018 IUCN red list. There were only 50,000 mature individuals in the wild, however, populations are slowly rebounding according to surveys.

Current IUCN REDLIST species extinction threat level								
NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENGANGERED	EXTINCT IN WILD	EXTINCT



# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Genus (Megaptera)



FIGURE 24: IMAGE OF HUMPBAC  
WHALE PROVIDED NOAA.GOV

Genus Megaptera is not a monotype genus; it contains at least three subspecies of humpback whales. These subspecies are the North Atlantic, North Pacific, and Southern Indian humpback whales. All subspecies are migratory in nature like most other baleen species. Their most distinguishing characteristic is the haunting mating songs that males vocalize. Their sizes range up to fifty-two feet and thirty-nine tons. Their populations are currently larger and adequately represented than other baleen whale species in most environments. They also compete with right whales for territory, making the conservation efforts of these species more complex.

Humpback whales (*Megaptera novaeangliae*) – The humpback whale has increasing population trends with a current global population of 84,000! It was listed among the species of least concern as part of the 2018 IUCN evaluation with an upward population trend.

Current IUCN REDLIST species extinction threat level								
NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENGANGERED	EXTINCT IN WILD	EXTINCT

## Family (Eschrichtiidae)



FIGURE 25: IMAGE OF GRAY WHALE  
PROVIDED NOAA.GOV

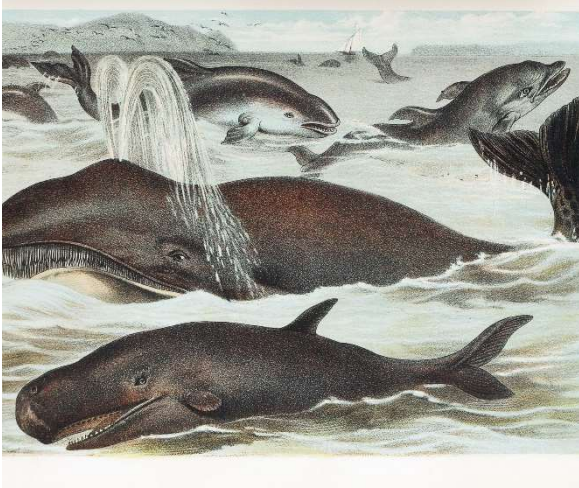
Gray whales are known for their characteristic appearance. They exhibit a streamlined form and are medium sized for baleen whales, ranging up to 50 ft in length and forty tons. Their body is gray in color and exhibits barnacle patches. They were once nearing extinction due to human whale hunting. Their populations are healthier now; however, they face increasing threats from climate change, habitat destruction, noise pollution, and the offshore oil industry.

Gray whale (*Eschrichtius robustus*) – The 2017 IUCN assessment listed the gray whale extinction risk as the least concern, and they have a stable population trend!

Current IUCN REDLIST species extinction threat level								
NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENGANGERED	EXTINCT IN WILD	EXTINCT

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Fast Whale Facts



**FIGURE 26: IMAGE PROVIDED BY  
PUBLICDOMAINPICTURES.NET AND ANDREA STÖCKEL**

**“Whale Falls”** - Whales help to preserve their environment even as they day. As a whale dies, it sinks to the ocean floor. Like phytoplankton, they store copious amounts of carbon that they retain in death and transport to the sea floor. Some estimates indicate the world has lost a 9-million-ton carbon sink due to whale population declines associated with whaling. Further, the seafloor has also lost many vital and resource-rich habitats due to whale population declines. The death of a single whale can nourish a specialized habitat that sustains for decades after the whale dies.

**Cornell’s Bioacoustics Center** – The Marine Mammal Protection Act of 1973 was the impetus behind much of the Conservation Bioacoustics movement and Cornell’s conservation bioacoustics center. The act established a national policy to prevent marine mammal species and population stocks from declining beyond the point where they ceased to be significant functioning elements of the ecosystems of which they are a part. The impact on whales was large since their population's levels had already declined significantly. Further, the act tasked three federal agencies with enforcing its regulations and shifted the responsibility of conservation from resource managers to resource consumers. The combination of these factors created a swell of resources to comply with the new legislation.



# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Section III: Conservation Pomology



FIGURE 27: IMAGE PROVIDED COURTESY OF BIODIVERSITY HERITAGE LIBRARY

### Pomology

Pomology is the subfield of horticulture involving the growing, storing and processing of fruits. Horticulture is the broader science researching sustainable production, marketing, and use of high-value, intensively cultivated food and ornamental plants. Horticulture crops include annual and perennial species, fruits and vegetables, and ornamental and landscape plants. Horticulture contains the subfields of pomology and olericulture. Olericulture is the science of cultivating leafy herbs like asparagus, lettuce, cauliflower, tomatoes, and peas.

#### Important Conservation Threats in Pomology

1. Soil Degradation
2. Extreme Weather Events
3. Climate Change
4. Monocultural Crop Breeding
5. Declining human populations

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Pomology Conservation Importance

Fruits and nuts are critical to the global human populations nutritional status, economy, and many of the world's contemplative traditions. Therefore, the primacy and comprehensiveness of the research into our world's fruits is critical to our futures.

## Food Security

Fruit and nut crops provide critical nutrients to a balanced diet! They promote health by alleviating many of the world's most widespread and debilitating nutrient-related disorders! Indigenous people are especially at risk of poor-quality diets due to their socioeconomic standing and suffer from considerable health disparities as a result.

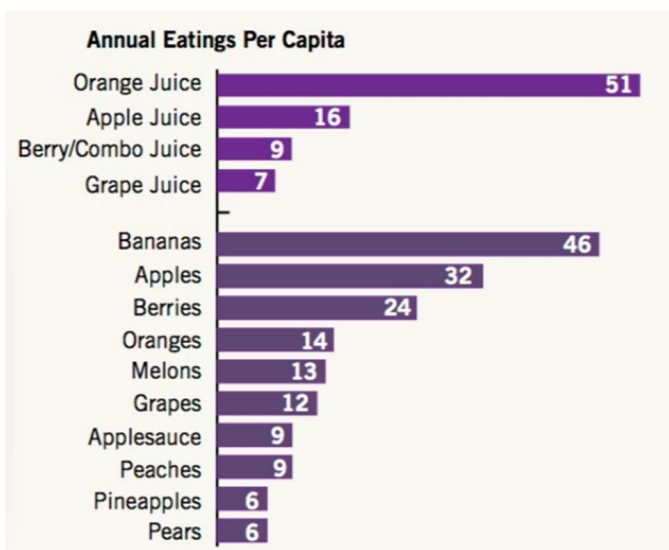
Fruits and nuts are amongst the most antioxidant-rich foods in our diets. The vibrant colors that characterize fruits evidence their antioxidant potency. These antioxidants protect against oxidative stress. Many scientists now consider a body's oxidative stress level a key indicator of health aging.

ORAC scores are a quantitative measure of a food's antioxidant level. Blueberries are phenomenal source of antioxidants. Wild Blueberries have an ORAC level of 9,621. Meanwhile, the widely acknowledged nutritional powerhouse green leaf lettuce achieves an ORAC level of 1,523. Grapes and their byproducts are known for their high resveratrol levels and the heart health they can bring the consumer.

Fruits and nuts are not just pivotal sources of antioxidants; they are also incredibly nutrient dense in other ways. These agricultural crops are rich sources of vitamins and minerals. Moreover, the breadth of fruits and vegetables cultivated provides a wide breadth of different vitamins and minerals. Apples are substantial sources of vitamin C, potassium, magnesium, and fiber and can help lower human risk of heart disease, cancer, stroke, and obesity. Avocados provide an even wider diversity of nutrients and health benefits. The fruit has prominent levels of fiber, magnesium folate, and vitamins B6, E, and K. Meanwhile, A single orange can provide 91% of a person's daily vitamin C requirement, and eating a single banana provides the consumer with 27% of their daily vitamin B6 requirement, 12% of their vitamin c requirement, and 8% of their daily magnesium need. A comprehensive analysis reveals every fruit as a nutritional powerhouse in its own way.

## Financial Importance

Fruit and nut production is also critical to our world's economy. Fruits are amongst the world's highest-value crops! Domestically grown fruits and tree nuts generate over \$25 billion (about \$77 per person in the US) in farm cash receipts annually. And the 7 percent of agricultural cropland of farmland devoted to fruits is responsible for 13 percent

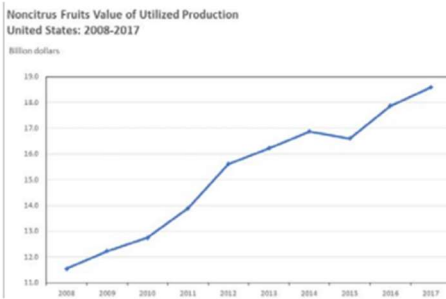


**FIGURE 28: USDA NONCITRUS FRUITS AND NUTS 2021  
SUMMARY**

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

of all crop income. Additionally, the industry's income is growing quickly as shown by 90% growth between 2008 and 2017.

Further, fruits are important components of the world's growing global economic markets. The United States utilizes its naturally fertile lands to grow some fruits in excess of the nation's needs to achieve a trade balance with other countries. Specifically, the United States sends 50% of the domestically grown Walnuts, Almonds, and Pistachios to other nations. Further, the United States currently accounts for 75% of all the almonds growing globally!



**FIGURE 29: USDA NONCITRUS FRUITS AND NUTS 2021 SUMMARY**

Non citrus Fruit Value of Utilized United States: 2008-2017

The market is estimated at an astonishing 2 billion dollars (about \$6 per person in the US)! Additionally, over 770 million dollars of apples and \$600 million of grapes are shipped abroad annually. Meanwhile, 30-40% of the oranges grown domestically are exported. The trade importance of the pomology industry extends into processed foods too! Major processed foods exports include orange juice and raisins.

Finally, the environmental importance of fruits and nut trees to their habitats is profound. Pollinator insects are under existential pressure due to decreasing plant diversity, pesticide use, and climate change. Fruit and nut trees can provide these bugs with potent ecosystems due to their extensive pollen and flowering potential. Apples, plums, and pears are incredibly rich pollen sources for bees. Further, the fruits and nuts of pomology provide critical nutrition for animals too! The fig tree is particularly well known for its symbiosis with the fig bat. And they form synergistic relationships with many plant species in natural environments also, providing flora shade and attracting beneficial animals and bugs.



# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## 2021 Global Fruit Production

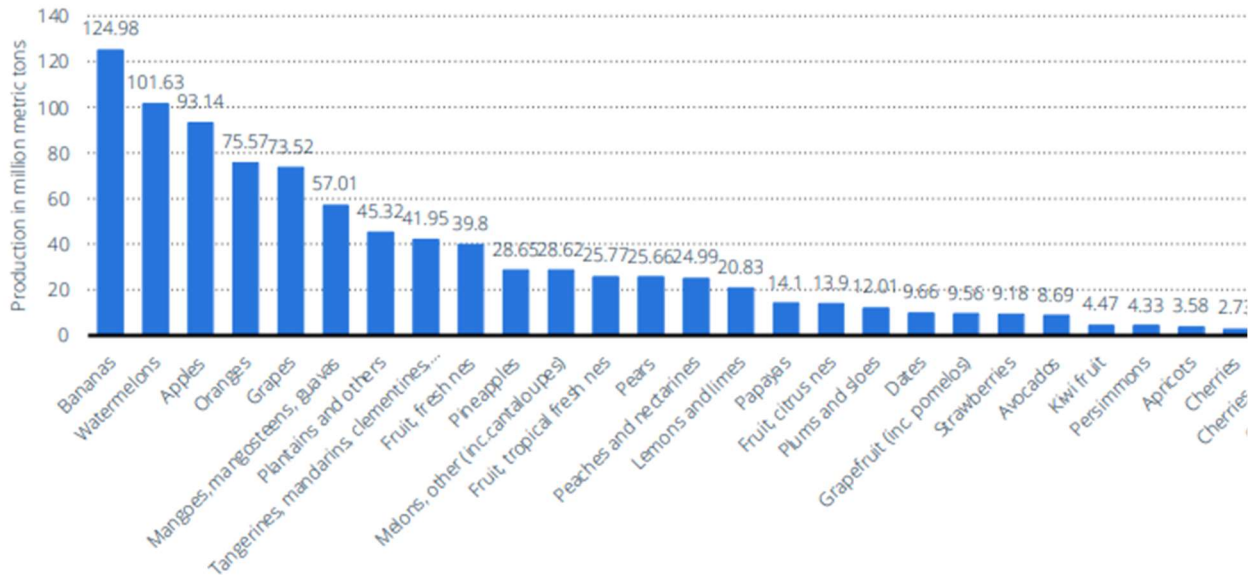


FIGURE 30: USDA NONCITRUS FRUITS AND NUTS 2021 SUMMARY

## Cultural and Religious Importance

Fruit has played a formative role in many cultures, contemplative traditions and religions. From the bodhi tree in Buddhism to the forbidden fruit in Christianity, pomes have played an influential role in the world's diverse spiritual and contemplative traditions. It also plays a significant role in many of the world's schools of mythology.

- **Apples** – apples are a symbol of temptation, knowledge, love, beauty, and wisdom in different relationships. In Christianity, they were the forbidden fruit in the Garden of Eden. In Greek mythology, the Earth Goddess (Gaia) presented an apple tree to Hera and Zed on their wedding day to symbolize their love.
- **Figs** – The fig is the symbol of enlightenment in Buddhism.
- **Oranges** – During the European Renaissance, artists utilized the citrus fruit as an expression of the sun, warmth, and sexuality.
- **Peaches** – Peaches have symbolized fertility during different periods of history. They were also prominent status symbol among Asian kings and emperors.
- **Pear** – The pear is sacred to three of the seminal goddesses of Roman, and Greek mythology (Hera, Aphrodite and Pomona)!
- **Plum** – In Asia, the plum blossoms the beauty of a young woman and the five petals of the drupe's flower represent the five Chinese gods of happiness.
- **Pomegranates** – In Greek Mythology, the goddess Persephone was confined to the



FIGURE 31: IMAGE PROVIDED COURTESY OF BIODIVERSITY HERITAGE LIBRARY



# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

underworld for part of each year after snacking on the seeds of a cursed Pomegranate fruit. According to the legend, the world is barren the portion of the year that she spends in the underworld, or the winter season.

- Strawberries - an important cultural food for tribes in the southeastern United States. The Seneca considers the Strawberry a symbol of Spring and Fertility.

## Fun Facts about Fruit

- Avocados and Pumpkins are fruits, not vegetables!
- One-half cup of Figs has as much calcium as a glass of milk contains!
- Apples float in water because they consist of 25% air!
- Bananas have a natural antacid effect on the body!
- Avocados, tomatoes, eggplants and bananas are types of berries. Meanwhile, from a botanical perspective, a strawberry is a false fruit and not a berry!
- Raspberries, apples, and peaches are members of the rose family!

## Types of Fruit

Pomology includes the production of fruits and nuts because tree nuts are categorized botanically as fruit!

Important types of Fruits and Nuts				
Fruit				
Grape (including Raisin)	Kiwi	Olive	Plum (including Prune)	Fig
Pear	Aronia berry	Breadfruit	Cranberry	Suriname
Citrus	Litchi	Papaya	Pomegranate	Cherry
Peach	Avocado	Cacao	Currant	Gooseberry
Cherimoya	Banana	Passion Fruit	Quince	Blueberry
Apple	Mango	Cherry	Date	Coffee
Guava	Blackberry	Persimmon	Raspberry	Strawberry
Apricot	Nectarine	Pineapple	Feijou	

Nuts	
Almond	Walnut
Cashew	Filbert (Hazelnut)
Pecan	Macadamia
Chestnut	
Coconut	
Pistachio	

## Careers in pomology

- Researcher
- Academic Instructor
- Large scale orchard manager
- Pomology extension associate

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Section IV: Fig Tree Conservation



FIGURE 32: IMAGE COURTESY OF FREEPIK.COM



The common fig tree is one of the oldest cultivated plants. Their fruits reached popularity because of their pleasant taste and medicinal value. The fig tree is part of the mulberry family (Moraceae). It is a deciduous multi-stemmed plant. It can grow as a tree or a bush. Figs constitute an important part of the Mediterranean diet because they can be eaten fresh or dried and they provide an important source of trace minerals, antioxidants, phenolic compounds, and sugars. The fig fruit's ORAC score is a robust 3,383. Meanwhile, the widely acknowledge

nutritional powerhouse green leaf lettuce has an ORAC score of 1583. Higher ORAC scores indicate more antioxidant activity. The fig plant is also an important part of the biodiversity in the forest ecosystems. It plays a prominent role as a food resource for declining insectivorous birds.

### Figs on demand

FIGURE 33: IMAGE BY FREEPIK.COM

### Scientific Name

*Ficus Carica*

**Fast fig fact** – The word *Ficus* translates to edible from its native Latin. Meanwhile, *Caria* is a region in southwestern Turkey known for growing figs.

### FIG TREE CONSERVATION IMPORTANCE

- Important role as food source for many animals from bats to monkeys to birds!

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

More than 850 species of trees, shrubs, and vines belong to the Moraceae family. Among these plants, 87 varieties produce edible fruit.

## Plant Family

Mulberry (Moraceae)

**Fast Fig Fact – Ficus Elastica (Indian Rubber tree) is a member of the Ficus genus. It was once a predominant source of natural rubber in the world.**

## Important Pests and Diseases

The Fig Beetle

Fig Mites

Fig Mosaic Virus

## Plant Type

Deciduous

Can be grown as shrub or tree

## Native Region

Syria is generally considered the origin of the domestic fig. The plants were then transported to North African and Asian countries. Egypt and Iraq figured prominently as ancient homes for the tree's migration.

## Fig Production Methods



**FIGURE 34: IMAGE PROVIDED COURTESY OF RAWPIXEL.COM**

The fig is traditionally grown in orchards as prominent trees dominating expansive acreage. Further, the fruits have required little care and human intervention in their native regions. This efficiency has driven their popularity to the warm, dry climate that plagues most fruit harvests in the Mediterranean region. The crops' reliability has resulted in a tremendous versatility of uses and meaningful cultural significance amongst the region's cultural traditions.

The dried version of the fruit also requires very little processing. Traditionally, farmers would allow the figs

## WHY THE FIG IS IMPORTANT FOR CONSERVATION

- Adaptable and thrive in many diverse conditions.
  - Soils
  - Sun
  - Temperature
  - Region
- Propagate easily!
- Able to tolerate increasing bouts of extreme weather.
- Require very few growing amendments.
  - Easy to grow.
  - Do not contribute to demand for petroleum-based fertilizers.
- Taste good!
  - Cherished fresh and dried.
- Nutrient/ Antioxidant dense!

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

to ripen on the tree. The ripe figs drop to the ground and are dried by the sun over the next few days leaving them ready for harvest.

There have recently been investigations and movement toward higher density orchards with more processing involved for fruit production. The hope is the research will increase production efficiency.

**Fast Fact:** Almost all figs worldwide are grown organically because the fig trees are fertile and resilient to growing conditions. The plant also has tremendous versatility of uses. The fig leaf is also utilized as a source of perfume in France. The seeds also contain an oil that is utilized as a humectant in beauty products.

## Dry v. Fresh



Figs accounted for 8% of the dried fruit market with 544 million in total value sold during 2020. The market is expected to grow at an annual rate of over 5% per year through 2027 to 787 million. The total dried fruit market is currently 6.2 billion dollars (about \$19 per person in the US).

The dried fig market is a significant portion of all fig production. It currently accounts for about 25% of the worldwide fig production in 2021. Meanwhile, the United States' fig production acreage is inexplicably decreasing. Nearly all the figs that are imported to the

United States are dried or transformed into fig products including preserves jams and baked goods. Additionally, 87% of the Figs produced in California were also processed!

**FIGURE 35:** IMAGE BY RAWPIXEL.COM

## Significance

### Financial

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

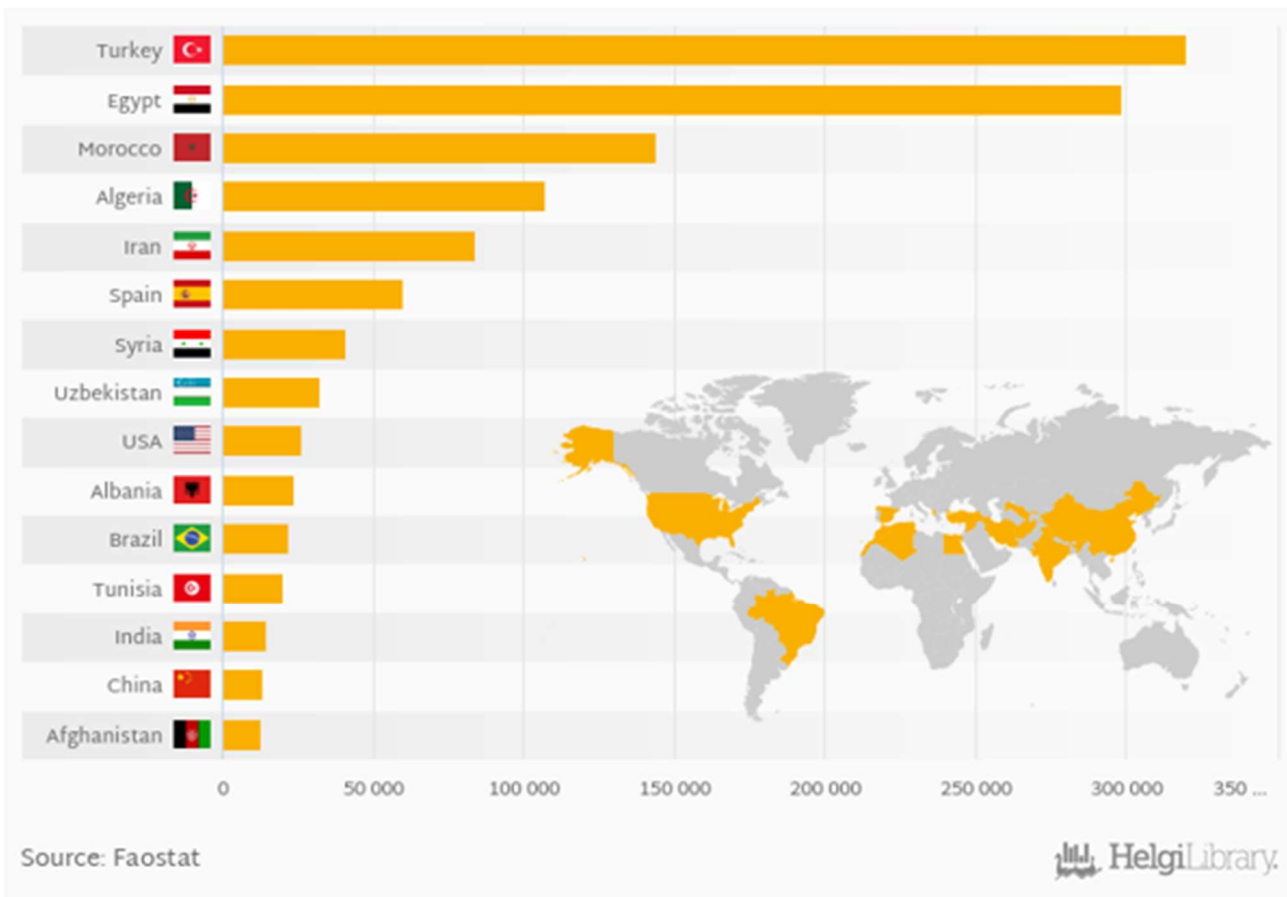


FIGURE 36: IMAGE BY HELGILIBRARY

Turkey is the worldwide leader in annual fig production and responsible for 262,644 tons of production. This tonnage accounts for more than 20% of worldwide production. They export more than 40% of their domestic fig production. Turkey also ranked as the top net exporter of figs. Their net trade balance was 335 M. In the United States, this most popular dried variety is a Smyrna type grown in Turkey and referred to as the Turkish Fig. Egypt also checks in high on the world's overall fig production lists producing 203,000 tons of figs. And cumulatively, the six middle eastern nations of Turkey, Egypt, Morocco, Algeria, Iran, and Spain are responsible for over 70% of the worldwide fig production.

The fig fruit is a net import for the United States. It imported 48 million dollars of figs in 2021. Imports are 6% of the worldwide market. This resulted in net imports of figs of 37 million dollars in 2021.

The United States produces 43,001 of figs per year and was responsible for a 4% of the global fig production in 2021. California accounts for a whopping 98% of the nation's fig production! The exception to California current



# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

nationwide fig supremacy occurs amongst an cult like following of backyard grower spread out throughout the nation. The fig plants are quick to mature nature and the ability to grow in small spaces make it a favorite for hobbyist growers.

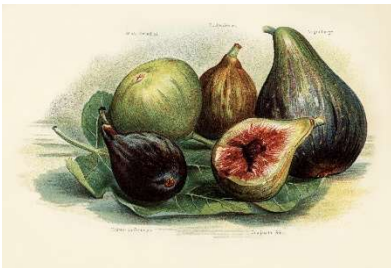


**FIGURE 37: IMAGE PROVIDED  
COURTESY OF RAWPIXEL.COM**

With the world's increasing extreme weather events fig plant's adaptability and resilience make it a plant ideal for expansion into new geographic areas. The popularity of the dried version of the fruit and the figures' significant nutritional profile also indicates the fruit's potential for increasing commercial production. The tree's adaptability to different growing conditions also means the fig needs very few growing amendments. This will reduce the need for carbon-based fertilizers and their increasing effect on global warming and overall climate change.

Further potential for the fig's production expansion is also buoyed by a fig research program at the University of California. The state university has heavily invested in fig breeding and development for the past 100 years. This research has been aided by collaborations with private fig growers in the region. Morocco and Syria are other global epicenters of current research into fig science.

## Important Commercial Varieties in the United States



**FIGURE 38: IMAGE PROVIDED  
COURTESY OF RAWPIXEL.COM**

**Black Mission Fig** – This black mission fig is characterized by purple colored skin and pink pulp. The shade of the interior and exterior grows deeper as the fruit is dried. The dried version, which is primarily the version available outside California, is known for its savory earthy molasses-berry type flavor and its gummy texture.

**Turkish Calimyrna Fig**- This Californian- grown version of the unique Smyrna fig is one of the few commercial varieties that is pollinated by the fig wasp. The skin is pale green and sometimes yellow and transitions to tan after the drying process. It is known for the rich complexity of its berry/nut taste profile.

**Bonus Fact** – Black mission figs were brought to the United States by Franciscan missionaries. These figs were later named for the missionaries that transported and planted them in California!



# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Important Commercial Varieties in the United States











DARK SKIN FIGS		FIG FLAVORS, PULP & SKIN COLORS		LIGHT SKIN FIGS		
BROWN / MAROON / LAVENDER / BLUE / PURPLE / BLACK	Mt Etna, Madeira/Preto Ischia Black, Sultane CDDN, Bordissot Noire Violet Sepor <b>PUNCH BERRY</b>  Ronde de Bordeaux Violette de Bordeaux Noire de Caromb Mission <b>RESIN BERRY</b> ("Bordeaux")  LSU Tiger Florea, Hunt Mega Celeste <b>SUGAR BERRY</b>  Improved Celeste O'Rourke Palermo Red Grantham's Royal <b>SUGAR</b>  Wuhan, Beall LSU Purple Osborn Prolific <b>CARAMEL</b>	PURPLE   RED   MAROON   BROWN   TAWNY 	DARK BERRY FIGS     SUGAR BERRY FIGS    DARK SUGAR FIGS	RED   RED   BLUSH   GOLD   YELLOW 	Nordland, Verte, Adriatic Ischia Green, Panachee Bordissot Blanca, CDDB <b>CITRIC BERRY</b> ("Adriatic")  White Triana Emerald Strawberry Lyndhurst White Conadria <b>TANNIN BERRY</b>  Brooklyn White Atreano Desert King <b>HONEY BERRY</b>  Kadota, Champagne Excel, LSU Gold Marseilles Pingo de Mel <b>HONEY</b>  Long Yellow Mary Lane Kalamata <b>AGAVE</b>	GREEN  

FIGURE 39: IMAGE COURTESY OF TONY CHRISTINI MOUNTAINFIGS.NET

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## Spiritual/Cultural

Hinduism – Vishnu, the protector and preserver of the Universe and the supreme deity in some Hindu sects was born beneath the fig tree and is associated with the trunk of the fig tree. Additionally, the Hindu god Brahma is associated with the roots of the fig tree and the goddess Shiva is associated with the leaves. Bonus fact: The fig tree pose is also a beginner's pose in yoga.



FIGURE 40: IMAGE PROVIDED COURTESY OF LOOKANDLEARN.COM

Islam – The holy book of Islam, known as the Quran, identifies the significant medicinal values of the fig tree.

Buddhism – The fig tree is known as the Bodhi Tree because the Buddha achieved nirvana after meditating beneath one such tree for 49 days (about 1 and a half months).

Christianity - The fig tree is featured prominently in Christianity. In the Garden of Eden, Adam and Eve used fig leaves to cover themselves after gaining wisdom. Some scholars believe that the fig might have been the original forbidden fruit.

## Traditional Medicinal Value –

In and China, the fig is used as an important remedy. It has been used to host a plethora of ailments including:

poor appetite	constipation	cardiovascular diseases
colic	Inflammation of the intestines	cancers
indigestion	Deteriorating vision	Blood sugar abnormalities
intestinal parasites	asthma	Boils and warts

Recent medical research has demonstrated the fig to have medicinal promise for lowering cholesterol, maintaining healthy blood sugar, in vitro efficacy against multiple cancers, and topically for skin disturbances! The researcher believes that the figs' high antioxidant levels are responsible for the ameliorating effects of the fig.

Latex – The fig also produces a natural latex substance inside its trunk and branches. The substance was once heavily utilized for natural rubber. Latex allergies can now make fruit harvest more complex.

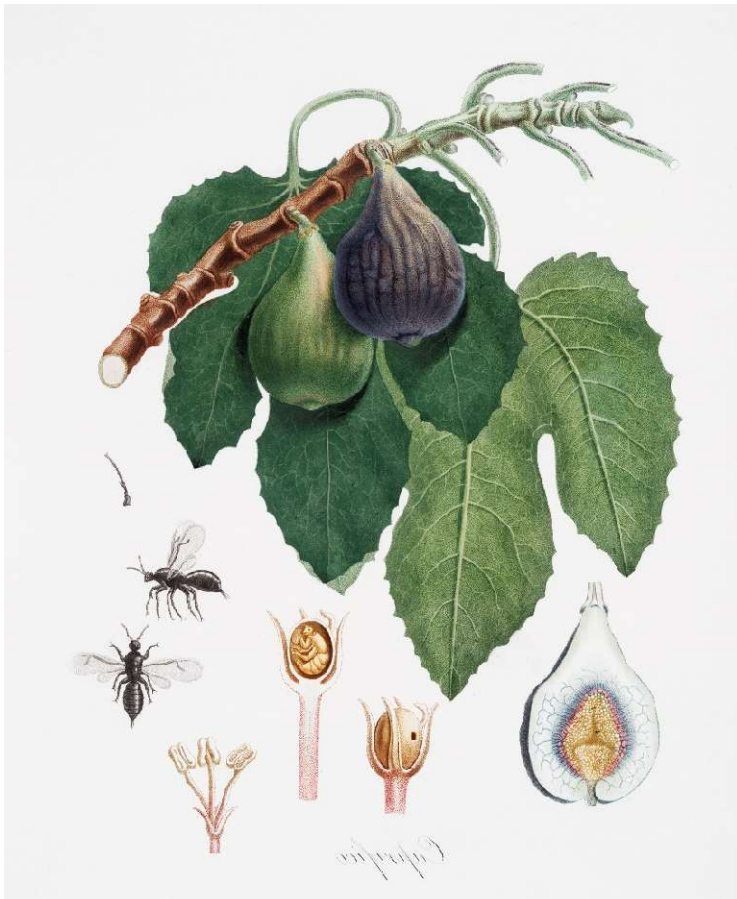
# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## More Fast Fig Facts!

### The Strangler Fig!

The strangler fig (*Ficus aurea*) is a member of the Moraceae family. It is native to the state of Florida and produces edible fruit. However, it is best known for its herbivorous nature tree that wraps around and grows up a host tree, eventually engulfing and killing the host.

### Are you eating Fig Wasps?



Many people are curious about the idea that a fig wasp remains inside the fig fruit for ingestion as part of the fertilization process. Few commercially grown fig varieties require fig wasp for fertilization. Instead, the most edible fig varieties are parthenocarpic in nature. Parthenocarpy is a plant's production of fruit without fertilization which makes the fruit seedless. This process can be artificially or naturally induced.

- The common fig plant is parthenocarpic
- San Pedro, Smyrna type, Caprifigs do require wasp fertilization to fruit, however, the figs utilize enzymes to break down any wasp inside their fruit. Ficin is a proteolytic enzyme able to metabolize protein into amino acids.

### Jail Birds

Female rhinoceros hornbills are sealed into the hollow trunks of trees by their male partner during pregnancy. Their male partner then delivers them figs to eat through the narrow crevices.

FIGURE 41: IMAGE PROVIDED COURTESY OF RAWPIXEL.COM



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## Section IV: Conservation Activities FUN WITH FIGS

### Classroom Pomology Assignment

#### Assignment 1: Propagate a fig tree!

##### a. Choose one variety of fig tree or multiple varieties!

- i. Some varieties are easiest to propagate, and other varieties taste best.
  1. The celeste fig tree is known to grow fast with fig fruits that ripen early from cuttings.
  2. The Violette de Bordeaux variety is well known amongst collectors for its supreme rich berry taste.
  3. Make sure the variety that you choose is suitable for your growing zone or that it grows well in pots.

##### b. Procure about 4 cuttings per student!

- i. The cuttings will be available most abundantly during the late fall and early winter.
  1. This is the time of year when cuttings can be most effectively made on live trees!
  2. Cuttings can also be obtained during the spring when removing the growth will awaken the potted adult tree from dormancy.
- ii. Fig tree cuttings are cheap and abundant.
  1. They can be found on eBay, Etsy, or gardening sights (Peacefulharvest.com)



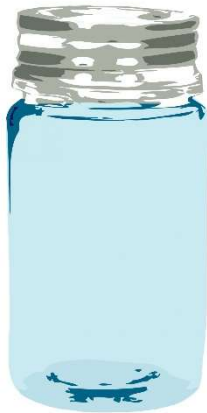
FIGURE 42: IMAGE COURTESY OF  
AGGIE-  
HORTICULTURE.TAMU.EDU/

##### c. Choose a technique!

- i. Indoor Rooting
  1. Items needed:
    - a. 6-inch pot
    - b. 2-liter bottle
    - c. Soil
    - d. Rooting Hormone
  2. Step 1: Dip in the rooting hormone to enhance root growth and add a plant sealant on the flat tip to prevent disease and sap loss.
  3. Step 2: Line the planter with a sheet of paper, add 3 inches of potting soil.
  4. Step 3: Situate cuttings in an upright manner and add more soil until the pot is  $\frac{3}{4}$  full.

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5. Step 4: Cut the bottom of the 2-liter bottle off to create an atmospheric dome over pot to retain the humidity.
  6. Step 5: Situate the pot near an indirect heat and light source.
  7. Step 6: Observe
  8. Step 7: Remove the bottle about 1 week after you observe leaf growth.
  9. Step 8: Eat Figs!
- ii. In water
1. Items needed.
    - a. Water
    - b. Mason Jar



2. Step 1: Fill a mason jar about halfway with water.
3. Step 2: Mark the water line on the mason jar.
4. Step 3: Place the cuttings in the jar.
5. Step 4: Change the water daily and refill it to the line marked on jar.
  - a. Rinse cuttings at the same time!
6. Step 5: Transplant cuttings to pot or outdoor garden after 3-4 weeks of growth.
7. Step 6: Eat Figs!

**FIGURE 43:** IMAGE PROVIDED COURTESY OF  
PUBLICDOMAINPICTURES.NET

# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

## GETTING EARS ON CONSERVATION BIOACOUSTICS!

### Classroom Bioacoustics Activity

#### Assignment 1: Getting involved with Bioacoustics!

##### a. Learn about Rainforest Connection!

- i. Rainforest Connection prides itself as an organization that “utilizes acoustic monitoring systems to halt illegal logging and poaching and enable biodiversity measurement and monitoring.”
  1. It does this worldwide with state-of-the-art scalable deployable acoustic monitoring systems that, with the help of its partners, it deploys worldwide.
  2. Its three main goals with its acoustic network and monitoring are to prevent illegal deforestation, stop animal poaching, and create the largest searchable audio ark of rainforest and eco data.
- ii. The organization’s free smartphone app is a bioacoustics platform that lets you listen to real-time audio files in natural habitats worldwide.

##### b. Download Rainforest Connection Application to your smartphone!

- i. Step 1: Student Assignment!
  1. Have each student listen for 5 minutes to 10 distinct habitats.
  2. Have each student record observations.
    - a. How was the habitat different than they expected?
      - i. How was the habitat different than they expected from an acoustic perspective?
      - ii. How was the recording as the students expected it to be?
      - iii. Are there local habitats that are like it currently in nature?
        1. How do they compare?
  3. Listen to and discuss each student’s most interesting habitat in class.
    - a. Have the student lead the discussion utilizing the assigned talking points.



##### c. Learn about Cornell’s Center for Bioacoustics (Lisa Yang Center)

1. The Yang Center’s mission is to collect and interpret sounds in nature by developing and applying innovative conservation technologies across ecologically relevant scales to inspire and inform the conservation of wildlife



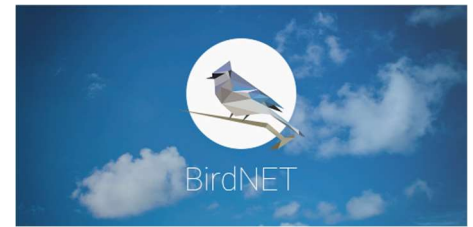
# ENVIRONMENTAL CONSERVATION FACT SHEETS AND ACTIVITIES

and habitats. They have terrestrial, marine, and aquatic projects. They also have a technology team that has been at the forefront of bioacoustics technology development and a capacity-building staff tasked with sharing the research with the worldwide community and developing partnerships.

2. The BirdNET, Elephant Listening, Rockhopper, Swift, Raven Pro projects are some of the more noteworthy current ventures.

## d. Download the Cornell Universities BirdNET application to your smartphone!

- i. The application utilizes computerized algorithms to recognize birds from sounds in nature. The algorithms are based on artificial neural networks. It hopes to provide innovative tools for conservationists, scientists, and birders.
- ii. BirdNET can currently identify around 3,00 of the world's most common species.
- iii. Student Assignment!
  1. Have each student become acclimated to the BirdNET application for homework?
  2. Take a field trip to a local nature habitat!
    - a. Observe the environment!
      - i. What did the group hear?
        1. In the Biophony?
        2. In the Geophony?
        3. Was there Anthropogenic Pollution? What were the sources?
      - b. Do you hear birds?
        - i. Use the BirdNET application!
          1. What types of birds are there in the environment?
        - c. Have fun!
    3. Discuss the findings on the field trip!
      - a. What was expected in the environment?
      - b. What was the least expected observation in the habitat?
      - c. What types of birds were present?
        - i. Were there any rare birds?



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