

Coral Reefs



Objective

Students will leverage some of the tools and features available within *ArcGIS Online* to visualize and assess globally the areas of coral bleaching and disease between the years 2000 and 2006. Students will also have an opportunity to explore factors (i.e., water temperature, population density) related to the health of coral reefs and discover their relative and absolute locations.

This activity can be used as an introductory lesson about coral reefs. A more in depth lesson is available using ArcGIS for Desktop10.x - $\frac{\text{http://esri.ca/en/content/coral-reefs}}{\text{content/coral-reefs}}$

Connections to Curriculum Topics

- Resource Management
- Physical Geography
- Environmental Issues
- Climate Change
- Population Density

Requirements

- Internet browser (e.g., Internet Explorer, Firefox, Chrome)
- Esri Global Account (optional)**

Background

Coral reefs are diverse ecosystems that provide protection to shorelines, contain medicinal properties for humans and economic opportunities for local communities, but they are at risk due to human actions. Increased carbon-dioxide emissions from the burning of fossil fuels are changing climate and ocean temperatures causing coral bleaching in many parts of the world. In addition, agricultural run-off, unsustainable tourism practices and destructive fishing practices are killing coral reefs and the life forms



that rely on them. Many organizations have been working together to create global awareness about this dire problem.

For more information, please visit these links:

- ReefBase Coral Bleaching <u>http://www.reefbase.org/global_database/default.aspx?section=t4</u>
- NOAA Coral Diseases <u>http://coris.noaa.gov/about/diseases/</u> (White Plague)
- Reefs at Risk <u>http://www.wri.org/project/reefs-at-risk/</u>

Data

- ReefBase <u>www.reefbase.org</u> (Bleaching, Diseases, ICRAN sites)
- Climate Change 3 Lesson <u>http://www.esri.ca/en/content/climate-change-part-3-impacts-view</u> (Ocean temperature data)

Note: The Education team at Esri Canada makes every effort to present accurate and reliable information. The Web sites and URLs used in this lesson are from sources that were current at the time of production, but are subject to change without notice to Esri Canada. It is recommended that teachers test all links within the Web GIS lesson prior to students working through the individual lessons.

Getting Started

- 1. Start by typing the URL https://www.arcgis.com/ into your Web browser.
- 2. Sign in using your ArcGIS Online account if you would like to save your map. If you do not have an account, you can create a <u>Public Account</u>.
- 3. In the search box in the top right of the homepage, search for "Coral Reefs (web lesson)".
- 4. Locate the Web map titled "Coral Reefs (Web Lesson)" by ESRICanadaEd and Open in ArcGIS.com map viewer.

Adding a Map Service (Data) to your Map

- 5. Click on the Add 🔛 button and then select Search for Layers.
- Type "Coral reefs 2010" in the search box to find this map service. Make sure the "In" section is ArcGIS Online.
- 7. Click Add to include Global Distribution of Coral Reefs (2010) on your map.
- Search for layers to add × Find: Coral reefs 2010 GO In: ArcGIS Online What kind of layers can I add? 1 result found Global Distribution of Coral Reefs (2010) by UNEP-WCMC-Global Add

- 8. Click **Done Adding Layers**.
- 9. You may need to **Zoom out** on your map to view the global distribution of coral reefs.



Location of Coral Reefs (Latitude)

- 10. Click on the **Measure** tool. Select the **Get the Location of a Point** tool and click on the northern part of the coral reef zone. Record the latitude, then click on **Get the Location of a Point** again and click on the southern part of the coral reef zone.
 - Q. What is the latitude range where the majority of coral reefs are located?
- 11. Click **Done** when you are finished.
 - Q. Why do you think they exist in this latitudinal zone?

Disease and Bleaching of Coral Reefs

- 12. Click on the **Show Map Legend** button to view the layers on your map.
- 13. Explore the map showing the location of coral reefs that have showed disease and bleaching.

Hint: Zoom into an area of your map by pressing the **Shift key** on your keyboard and at the same time drawing a box around the area you want to view.

- Q. In which regions of the world have coral reefs been affected by disease and bleaching?
- Q. What types of industries/activities do you think contribute to the decline in health of coral reefs? Why?

Viewing Contents of a Map

- 14. Click on Show Contents of Map
- 15. Click on Web Reef to view the layers below.
- Web Reef
 ICRAN
 Bleaching 2000-2006
 Disease 2000 2005
 □ Temperature (Celsius)
- 16. Uncheck the Disease 2000-2005 layer.
- 17. Click on the down arrow next to the **Bleaching 2000-2006** layer and select **Show Table**.

Q. What type of information is provided?



Creating Queries

- 18. Click on the down arrow next to the Bleaching 2000-2006 layer and select Filter.
- 19. In the *Filter* window:
 - a. Make the first expression as shown below:

BLEACHING_	-	is	-	HIGH		-
				O Value	Field	Onique
Ask for values	•					

b. Click Add Another Expression

c. The second expression should be:

YEAR	Ŧ	is	-	2006		-
Ask for values				🔾 Value	○ Field	Onique

- d. Click Apply Filter.
- 20. Zoom out of the map to view in which countries the high bleaching occurred in 2006.
 - Q. What countries had occurrences of high bleaching in 2006?
- 21. Go back to the filter you created for the **Bleaching 2000-2006** layer and remove the filter.
- 22. Turn off the **Bleaching 2000-2006** layer.
- 23. Turn on the **Disease 2000- 2005** layer.
- 24. Open the filter to create an expression to view where White Plague is found in the world.

DISEASE_TY	-	is	-	White plague		-
				O Value	🔘 Field	Onique
Ask for values	▼					

Q. Where is White Plague found in the world?



- 25. Remove the filter you created for the **Disease 2000- 2005** layer.
- 26. Turn on the **Bleaching 2000-2006** layer.

Exploring Population Density

- 27. Click on the Add 🔛 button and then select Search for Layers. Search for the "esri_population_world" map service and add it to your map.
- 28. In the Content window, move your layers so the ESRI_Population_World layer is below the coral reefs layer. To do this, click on the down arrow next to your layer and select Move Up or Move Down.
- 29. Explore the countries close to coral reefs and the locations where diseases and bleaching are found on the map.

Hint: Remember to use the Shift key to zoom into an area.

Q. To what extent do you think population density has an impact on areas of bleaching and disease?

Viewing Other Layers

- 30. Turn off the **ESRI_Population_World** layer.
- 31. Click on the Web_Reef layer and turn on I the Temperature (Celsius) layer.

Note: This layer is scale dependent, so it will only appear at certain scales.

32. Go to the map extent similar to the image below:



33. Click the **Map Legend** to view the <u>ocean temperature ranges</u>. **Note:** The Map Legend will only appear if the Temperature (Celsius) layer is present.

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- Q. What is the ocean temperature range where most coral reefs exist?
- 34. Turn on the ICRAN layer and turn off all the layers below it.

The International Coral Reef Action Network (ICRAN) is a global partnership of coral reef experts who are working to halt and reverse the health decline of the world's coral reefs. Made up of some of the world's leading coral reef scientists and conservation groups, ICRAN partners have created a globally integrated action plan to manage and protect coral reefs based on recommendations from the International Coral Reef Initiative (ICRI). The International Coral Reef Action Network is a coordinated response to ICRI's urgent call to protect coral reefs. Specific sites have been selected to serve as "demonstration sites" based on their proven ability to effectively manage their coral reefs. These sites share local knowledge and successful management practices with other coral reef managers and communities."Target sites" are sites where best practices implemented at the "demonstration sites" can be adopted.

For more information on ICRAN, visit: <u>http://www.icran.org</u>

Q. What areas of the world would you recommend to ICRAN to expand its reach? Why?

Extension Exercise

Create two new queries to show the "Demonstration Site" and the "Targeted Site" using the ICRAN layer (TYPE_DESCR field).

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