Threats to Biodiversity:
Local versus Global Perspectives

Exercise

James P. Gibbs

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BACKGROUND
Although species extinctions are part of the evolutionary process, current extinction rates are much greater than at any time in the last several million years. Current extinction rates are about 2,500 times the background rate at which species have disappeared due to evolution, and equate conservatively to a loss of at least two species an hour. To address this issue, we need to understand, what are the major threats to biodiversity?

Many human activities threaten biodiversity either directly or indirectly, and virtually all, current extinctions are due to human activities. While a myriad of threats potentially undermine biodiversity, each species faces its own specific suite of threats. Moreover, species in different regions of the world are more prone to some threats than others. If we are to mitigate these threats we must first understand what specifically is threatening biological diversity in a particular region.

The World Conservation Union (IUCN) maintains a list of imperiled and extinct species, known as the Red List of Threatened Species. The list can help us to understand just what threatens biodiversity around the world. In this exercise, you will obtain a list of threatened species for your country and then contrast the causes of species imperilment in your country with that in the world at large. From this assessment, you will develop an understanding of the primary threats to biodiversity both locally and globally.

CLASSES OF “THREATS”
There are a variety of reasons why species are threatened with extinction. Threats to biodiversity are often grouped into five basic categories:

ECOSYSTEM LOSS
Humans supplant natural ecosystems to grow food, harvest materials, and build our settlements. These actions alter or eliminate the conditions needed for plants and animals to survive. Deforestation is of particular concern because so much biological diversity occurs in the complex environments created by forests. Timber harvest and conversion of forests to agriculture are major components of habitat loss. But so are coastal development, wetland loss, and conversion to
human uses of many other types of natural ecosystems and the species and populations that inhabit them.

**OVER-EXPLOITATION**
Over-use or over-harvesting of plants, animals or natural resources is another major threat to biodiversity. The resources humans consume to survive and attain various levels of comfort exert tremendous pressure on the world’s plants and animals. While direct use of wildlife and other natural resources is essential for human survival, their overexploitation is a critical problem in conservation. Logging, hunting or fishing can reduce populations to the point of extinction. The huge demand that a growing human population places on wild species for food, fiber, ornaments and other products can lead to greatly reduced and sometimes extirpated population. As, species’ populations decline, eventually they can no longer provide ecological services such as, pollination.

**INVASIVE SPECIES**
Organisms that are accidentally or intentionally transplanted from one ecosystem to another are a major cause of global species extinction. Native species can become invasive when natural controls on their numbers are removed and they reach plague proportions. Invasive species often destroy native species as the invasives expand in number and occupy habitats or compete for food, oftentimes so completely dominating an ecosystem that they cause native plants and animals to go extinct.

**POLLUTION**
Thousands of pollutants are discharged into the environment and their lingering presence threatens biodiversity, affecting individual species or degrading entire ecosystems. Pollutants resist categorization because of their varied forms and effects. Some directly toxify the environment, such as lead or PCBs, while others, such as fertilizer runoff, are non-toxic but harm aquatic systems by causing excessive plant growth. Noise and light pollution threaten species by disrupting their behavior. Pollutants are also classified (regardless of their form) by the environment they affect, such as air, water, and soil pollution. Many pollutants cycle through all these environments at some stage, entering the air and ending up in water or soil. We dispose our waste products into oceans, rivers, lakes, as well as on land. Pollutants enter the environment and are transmitted through the food web, thereby become integrated into the tissues of the living creatures. The Earth has a finite capacity to absorb, transform, and breakdown the large volumes of pollution we generate. Notably, some materials take thousands of years to decay (e.g., plastics), or may even become more toxic as they decompose.

**CLIMATE CHANGE**
Global climate change is expected to impact plants and animals worldwide. What these changes will be depends largely on the amount and rate at which the world’s climate warms. New studies and improved models are increasing our understanding.
understanding of global climate change. Over the past 140 years, the global average surface temperature has increased 0.6°C +/- 0.2°C. Combustion of heat-trapping gases such as coal, oil and natural gas to fuel the activities of our surging population is causing warming of the globe at unprecedented rate. Such warming may be altering the climate, leading to more intense heat and cold in certain locations, and more extreme weather events such as floods, droughts and ice storms. Because ecosystems are so closely associated with particular biophysical constraints unique to particular locales, sudden climate change potentially threatens them. Species unable to evolve, adapt or disperse fast enough to cope with these changes will go extinct.

Note that these are very general classes of threats. The IUCN provides a far more detailed breakdown of threats, which is available on their website (see “Threats authority file” at the bottom of the search screen). Become familiar with these categories.

**EVALUATING WHY SPECIES ARE THREATENED**

**You will collect data on**

1. the major threats to wild species in your country/region and habitat
2. the major threats to species around the world

To collect these data you will repeatedly query the IUCN database using different search criteria. Each search will enable you to determine the number of species in a particular region that are facing a particular threat. Lastly, you will interpret these tallies and make inferences about the relative importance of each threat at the scale of your country versus globally.

**STEP 1. SEARCHING THE IUCN DATABASE**

Go to: [http://www.redlist.org/](http://www.redlist.org/) and choose “Search” (you can do an “Expert search” but start with a basic search for now.)

Look over all the search criteria. You can query this database by Red List category (or species status), Country, Region of the World, Marine Region of the World, Major Habitat Type, and/or Major Threat Type. This is an extraordinary database for analyzing patterns of threats to biological diversity around the world.

Under "**Select one or more countries**" you can limit your search results to a specific country I recommend that you limit your search to the country or region and habitat that you will use in your research paper. Hold down the Ctrl-key to make multiple selections. Note that the search results, using the country search option, exclude any species that have been introduced to the country or countries concerned (in other words, only native species are included), irrespective of their Red List status. To search a region, choose a set of nearby countries that best represents that region.
Under "Major threat types" you can limit your search to particular threats to species, or select one or more threats. The major threat types are numbered according to a four-level hierarchical system. Selecting threat types from the second level and below, switches off the levels above and vice versa. For example, selecting "1. Habitat Loss/Degradation (human induced)" and "1.1.1. Crops" will only produce results for "1. Habitat Loss/Degradation (human induced)." Note that the threats may have been in the past, they may be creating an impact at present, they may only be future threats, or they may be ongoing (past, present and future). Because we are interested in general classes of threats, you should search the major categories one at a time. So start with: 1. Habitat Loss/Degradation (human induced). This will select all those species at risk from any type of human-induced habitat loss or degradation.

Then select "Search."

**STEP 2. INTERPRETING THE RESULTS OF THE SEARCH**
You will now see a list of species that meet the search criteria you have selected, that is, that occur in your country and are threatened by habitat loss and degradation. Look at the list of species. Do you recognize any of them? Do you have any personal knowledge of the specific habitat loss issues confronting any of them? Because we want to contrast threats by region and habitat, you are primarily interested in tallying the total number of species that were located by the search (see top of results screen, e.g., "Viewing results 1 to 50 of 162"). Record the total.

**STEP 3. PERFORMING THE REMAINING SEARCHES FOR YOUR COUNTRY/REGION.**
You want to obtain and record the total number of species in your country/region facing different threats. So, repeat the search process for your country/region and habitat, but only change the threat category. Repeat this for the following ten categories:

2. Invasive alien species (directly affecting the species).
3. Harvesting [hunting/gathering].
5. Persecution.
6. Pollution (affecting habitat and/or species).
7. Natural disasters.
8. Changes in native species dynamics.

Record the total number of species for each threat category. Use the following table to organize the data:
### Step 4. Getting a Global Perspective

Repeat Steps 1 to 3 but instead of selecting “Select one or more countries” select “All.” This will extract the total species recognized anywhere on the globe by the IUCN in relation to the type of threat. Record these totals, as you did for your country, but this time for the entire globe. **Convert the numbers in each threat class to a fraction of the total species across all threat classes in your country/region. Do the same for the global species tallies.**

### Assignment

Discuss which threats are most significant to species in your country/region. Similarly, discuss which threats are most important at the global level. Were there discrepancies between the country and the global level? If so, which threat categories were most different? What might account for these differences? This last question is fairly complex and requires you to think of the different social, economic, legal, and biological dimensions of your country versus that of the world in general. Finally, for your country, what does your assessment of threats suggest are the most important areas on which to focus conservation actions. This, too, is a very complex question but it is the heart of why we perform threats analysis in the first place.

<table>
<thead>
<tr>
<th>IUCN Threat Category</th>
<th>Your Country/Region &amp; Habitat</th>
<th>% of Total</th>
<th># of species</th>
<th>Global</th>
<th>% of Total</th>
<th># of species</th>
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<td>Habitat Loss/Degradation</td>
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<td>Invasive alien species</td>
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<td>Harvesting</td>
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<td>Accidental mortality</td>
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<td>Persecution</td>
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<td>Natural disasters</td>
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<td>Changes species dynamics</td>
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<td>Intrinsic Factors</td>
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<td>Human disturbance</td>
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<td><strong>Total # of species</strong></td>
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