INVESTIGATING ECOSYSTEM SERVICES

SUSTAINABILITY & CONSERVATION IN THE AMAZON - RESOURCE GUIDES

TEACHER NOTES

Why do we all need an intact functioning Amazon rainforest?

How could we possibly affect the health of the rainforest even if we live in a city perhaps thousands of miles away?

What benefits do trees provide, in the Amazon and in our home communities?

Students consider these questions on a global scale and calculate ecological benefits provided by their own nearby trees.

OPENER:

- Introduce the concept of Ecosystem Services with this ***2-page overview*** by the Ecological Society of America.

View of Maijuna-Kichwa Regional Conservation Area, Peruvian Amazon *Photo Credit: Scott Sprengel*

EXPLORE THE ROLE OF THE AMAZON RAINFOREST IN PROVIDING ECOSYSTEM SERVICES:

- Watch 5 min. National Geographic video, ***Amazon Deforestation & Climate Change*** *and/or*,
- Have students read ***Why are Rainforests so Important?*** by Dr. Jonathan Foley.
- Discuss questions such as these:
  - How could deforestation cause the Amazon to become a desert? (Even if the trees are cut, wouldn't the area still get a huge amount of rainfall?)
  - How does eating beef in other parts of the world affect the Amazon?
  - How does the Amazon rainforest affect the climate in other parts of the world?
  - What role does the Amazon play in the global carbon cycle?
  - What does the scientist in the video mean by "Plan B"? What ideas do you have for actions that would be included in Plan B?

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- Consider implementing this National Geographic lesson: ***Local and Global Effects of Deforestation in the Amazon Rain Forest*** – students identify areas of deforestation on a map of the Amazon, consider the role of the rainforest in maintaining water and nutrient cycles, and construct a scientific argument for the effects of deforestation on these cycles and on rainforest organisms.

CALCULATE ECOLOGICAL BENEFITS PROVIDED BY TREES IN YOUR COMMUNITY:

- Using the USDA Forest Service's ***i-Tree online software***, quantify the amounts and dollar values of the carbon, air pollution, and hydrologic benefits provided by trees based on the tree cover in a region you have selected

  and/or,
- Use the ***Tree Benefit Calculator*** to estimate the environmental and economic value provided by individual trees.

CABACKGROUND INFORMATION ON ECOSYSTEM SERVICES PROVIDED BY THE AMAZON

Indigenous forests could be a key to averting climate catastrophe
by S. Branford and M. Torres. Mongabay, 11/06/2017.

• A new study finds the world's tropical forests may no longer be carbon sinks, with a net loss of 425 million tons of carbon from 2003 to 2014. Also, 1.1 billion metric tons of carbon is emitted globally from forested areas and land use annually — 4.4 billion metric tons are absorbed by standing forests on managed lands, but 5.5 billion metric tons are released via deforestation and degradation.

• Curbing deforestation and degradation is now seen by scientists as a vital strategy for nations to meet the carbon reduction goals set in Paris in 2015, and of averting a catastrophic 2-degree Celsius rise in temperatures by the end of the century.

• Other new research finds that indigenous and traditional community management of forests could offer a key to curbing emissions, and give the world time to transition to a green energy economy.

Observations of increased tropical rainfall precededby air passage over forests
by D.V. Spracklen, S.R. Arnold, & C.M. Taylor. 2012. Nature 489, 282–285.
Editorial Summary: This global observational analysis demonstrates that forests exert a strong control on rainfall hundreds of kilometers downwind through a water-cycle feedback. When precipitation occurs, some of the water returns to the atmosphere through transpiration and evaporation. In the tropics, this process has long been thought to be an important part of the overall precipitation budget. But most evidence has come from modelling studies, which remain inconclusive. Spracklen and colleagues use remote sensing and atmospheric back-trajectory modelling to show that air passage over dense forests produces about twice as much rain as passage over sparse vegetation. They estimate a 1221% reduction in seasonal precipitation if Amazon deforestation continues at the current rate.

Mammal diversity influences the carbon cycle through trophic interactions in the Amazon

by M. Sobral, K.M. Silvius, H. Overman, L.F.B. Oliveira, T.K. Raab, & J.M.V. Fragoso. 2017. Nature Ecology & Evolution 1, 1670–1676.

Abstract: Biodiversity affects many ecosystem functions and services, including carbon cycling and retention. While it is known that the efficiency of carbon capture and biomass production by ecological communities increases with species diversity, the role of vertebrate animals in the carbon cycle remains undocumented. Here, we use an extensive dataset collected in a high-diversity Amazonian system to parse out the relationship between animal and plant species richness, feeding interactions, tree biomass and carbon concentrations in soil. Mammal and tree species richness is positively related to tree biomass and carbon concentration in soil—and the relationship is mediated by organic remains produced by vertebrate feeding events. Our research advances knowledge of the links between biodiversity and carbon cycling and storage, supporting the view that whole community complexity—including vertebrate richness and trophic interactions—drives ecosystem function in tropical systems. Securing animal and plant diversity while protecting landscape integrity will contribute to soil nutrient content and carbon retention in the biosphere.

Planetary health: protecting human health on a rapidly changing planet

by S.S. Myers, MD. 2017. The Lancet. DOI: http://dx.doi.org/10.1016/S0140-6736(17)32846-5.

Summary: The impact of human activities on our planet's natural systems has been intensifying rapidly in the past several decades, leading to disruption and transformation of most natural systems. These disruptions in the atmosphere, oceans, and across the terrestrial land surface are not only driving species to extinction, they pose serious threats to human health and wellbeing. Characterizing and addressing these threats requires a paradigm shift. In a lecture delivered to the Academy of Medical Sciences

Forest Carbon in Amazonia: The Unrecognized Contributions of Indigenous Territories and Protected Natural Areas

by W. Walker, A. Baccini, S. Schwartzman, S. Ríos, M.A. Oliveira-Miranda, C. Augusto, M.R. Ruiz, C.S. Arrasco, B. Ricardo, R. Smith, C. Meyer, J.C. Jintiach & E.V. Campos. 2014. Carbon Management 5, 479-485.

Summary by EDF: Protecting the vast amount of carbon stored above ground in the forests of indigenous and protected lands – totaling 55% of the Amazon – is critical to the stability of the global climate as well as to the cultural identity of forest-dwelling peoples and the health of the ecosystems they inhabit. Yet the authors also find that nearly 20% of tropical forests across Amazonia are at risk from legal and illegal logging, construction of new roads and dams, and the expansion of commercial agriculture, mining, and petroleum industries, pressures which are exacerbated in many countries because governments have failed to recognize or enforce indigenous land rights.

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