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Some Science Text Sets and Bibliographies

These science text sets attempt to represent not just a topic, but an issue within that topic, and sides of that issue. The text sets present multiple perspectives on a science issue—as well as multiple levels of texts and multiple modalities. The texts are arranged more or less from easier to harder. Some articles may need to be adapted for lower level readers, and some website text you may choose to move into Word and reformat so it is easier to read and has fewer distractors/ads. Be sure to capture the whole URL, without spaces for line-breaks, when you seek these online resources. Thanks to all the teachers who shared resources. If you have a bibliography you'd like to share with science teachers, please email us at: contact@readingandwritingproject.com.

Please keep in mind that websites are temporal and so might no longer be posted.

Aliens (Grades 5-8)

NASA confirms aliens exist as bacteria

<http://www.dogonews.com/2010/12/8/nasa-confirms-aliens-exist-right-on-our-planet>

Collection of unverified object in NASA and cosmonaut photos

http://www.youtube.com/watch?v=WILN_Jcg1pc&feature=related

Alien occupation of Earth's moon

<http://www.youtube.com/watch?v=iIW2cLOgMl8&feature=related>

NASA history of the 'face on Mars'

http://science.nasa.gov/science-news/science-at-nasa/2001/ast24may_1/

CNN report on government officials reporting UFOs

<http://www.youtube.com/watch?v=ZUdf8kRpLWs&feature=related>

Scientific explanations for alien abductions – Discovery channel article and video

<http://curiosity.discovery.com/question/explanation-alien-abduction>

Unsolved mystery account of kids claiming they saw UFO

<http://www.youtube.com/watch?v=u4uWVn9s4SE>

Bears

An Op-Ed on the dangers humans pose to black bears (adapted, simplified version of text attached)

<http://digitaljournal.com/article/291311>

An article on the danger of bears (adapted, simplified version attached)

<http://www.medicalnewstoday.com/releases/225029.php>

A book on dangerous animals that features the danger of polar bears, but also the fact that they are at risk: *Deadliest Animals*, National Geographic Kids

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A book on bear attacks

Bear Attacks by Patrick J. Fitzgerald

A video about bears that steal food from campers in Yosemite National Park

<http://video.nationalgeographic.com/video/player/kids/animals-pets-kids/wild-detectives-kids/wd-ep8-bearbandits.html>

A fact sheet about black bears:

http://www.state.nj.us/dep/fgw/bearfacts_kids.htm

Cell Phone Radiation and Brain Research (Grades 7-9)

(Compliments of Joshua Hurley-Bruno, School of the Future)

An article on electromagnetic fields and public health from the World Health Organization

<http://www.who.int/mediacentre/factsheets/fs193/en/#>

A review of cell phone radiation levels

http://reviews.cnet.com/2719-6602_7-291-1.html?tag=page;page

Article on how cell phone radiation works

<http://electronics.howstuffworks.com/cell-phone-radiation1.htm>

Description of a cell phone app that measures radiation

http://news.cnet.com/8301-30686_3-20017815-266.html#ixzz1Fq7yg7su

Video and article on the possible link between cell phone radiation and brain damage

<http://abcnews.go.com/Health/Wellness/cell-phone-study-cell-ups-brain-activity/story?id=12971636#.T2iL-MUgewQ>

Article on how cell phone waves excite brain cells

<http://www.npr.org/2011/02/22/133968220/cell-phone-radio-waves-excite-brain-cells>

Deforestation Text Sets

Attached at the end of this document are articles that have been adapted by teachers for classroom use.

“Deforestation in the Amazon,” by Emma Walsh-Alker (*Student Ambassador of One World Education*) (attached)

<http://www.oneworldeducation.org/deforestation-amazon>

“Threats to Madagascar's Biodiversity and Ecosystems” (attached)

<http://www.wildmadagascar.org/conservation/threats.html>

“Deforestation in Madagascar for Kids” (attached)

<http://www.wildmadagascar.org/kids/20-environment-deforestation.html>

“The Deforestation Debate,” *Scholastic News* (attached)

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<http://images.scholastic.co.uk/assets/a/7d/14/ceissue3a2iiback4-inp-528011.pdf>

“Deforestation,” *National Geographic* (attached)

<http://environment.nationalgeographic.com/environment/global-warming/deforestation-overview/>

“The Effects of Humans,” *Grolier's The New Book of Knowledge* (attached)

<http://teacher.scholastic.com/scholasticnews/indepth/rainforest/effects.asp>

“The Positive and Negative Consequences of Deforestation,” by Nathalie Fiset (attached)

<http://ezinearticles.com/?The-Positive-and-Negative-Consequences-of-Deforestation&id=525336>

“What are the Pros and Cons of Deforestation?” (attached)

<http://debate.yukozimo.com/pros-and-cons-of-deforestation/>

“Deforestation,” *Exploring Nature Educational Resources* (attached)

<http://www.exploringnature.org/db/detail.php?dbID=7&detID=71>

“Study: Economic Boost of Deforestation Is Short-Lived,” by Bryan Walsh of *Time Magazine: Science* (attached)

<http://www.time.com/time/health/article/0,8599,1904174,00.html>

To read more about this boom-and-bust pattern, please visit the following website for further information:
<http://www.time.com/time/health/article/0,8599,1904174,00.html#ixzz1zo5aP5Ma>

“Pros and Cons of Deforestation,” *EDU.UDYM.com* (attached)

<http://edu.udym.com/pros-and-cons-of-deforestation/>

“Poverty and Deforestation,” *The World Bank* (attached)

<http://go.worldbank.org/5I9M8XYBW0>

“Boom and Bust' of Deforestation,” by Richard Black (*Environment Correspondent, BBC News*) (attached)

<http://news.bbc.co.uk/2/hi/science/nature/8095833.stm>

“The Deforestation of the Amazon: A Case Study in Understanding Ecosystems and Their Value,” by Phil Camill (*Department of Biology at Carleton College*) (attached)

<http://library.buffalo.edu/libraries/projects/cases/amazon.html>

“Rainforest Wood” (Adapted from www.blurtit.com) (attached)

<http://library.thinkquest.org/27257/uses3.html>

“Keeping Forests Standing,” *Rainforest Alliance* (attached)

<http://www.rainforest-alliance.org/about/forests>

“Pre-industrial Deforestation Still Warming Atmosphere” by Jeremy Hance (attached)

<http://news.mongabay.com/2012/0703-hance-preindustrial-deforestation-carbon.html>

“How to Prevent Deforestation” (attached)

<http://www.buzzle.com/articles/how-to-prevent-deforestation.html>

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“Amazon Rainforest: Deforestation” video

<http://kids.britannica.com/comptons/art-106824/Deforestation-of-the-Amazon-River-basin-has-followed-a-pattern?&articleTypeId=31>

What are rainforests?

http://kids.mongabay.com/lesson_plans/handout.html

Reasons for deforestation, with stats

http://rainforests.mongabay.com/defor_index.htm

<http://kids.mongabay.com/elementary/501.html>

Interviews with a variety of scientists

<http://kids.mongabay.com/interviews.html>

Interview with an expert on sun bears and the effect of logging and wildlife trade on their population.

http://news.mongabay.com/2008/0925-wcn_wong_interview.html

Interview with a tropical forest researcher

http://news.mongabay.com/2008/0818-mitchell_interview_gcp.html

Eco/Carbon Footprint (Grades 7-9)

Definition of carbon footprint

<http://timeforchange.org/what-is-a-carbon-footprint-definition>

Dense explanation of carbon footprint

http://www.footprintnetwork.org/en/index.php/GFn/page/carbon_footprint/

Compute your ecological footprint

<http://www.islandwood.org/kids/impact/footprint.php>

World Wildlife Federation top ten ways to reduce eco footprint

http://www.wwf.org.uk/what_we_do/changing_the_way_we_live/cities/top_ten_ways_to_reduce_your_ecological_footprint.cfm

Investors put pressure on companies to reduce carbon footprint

<http://www.guardian.co.uk/sustainable-business/investors-demand-greenhouse-gas-reductions>

Verizon decides to cut its carbon footprint

<http://www.treehugger.com/green-investments/verizon-reduce-carbon-footprint-50-2020-ceo-says.html>

India suggests US reduce carbon footprint before pressuring others

<http://www.bloomberg.com/apps/news?pid=newsarchive&sid=a7WGSJvqXSyU>

Kristie Pelletier claims carbon footprint is a myth

<http://www.youtube.com/watch?v=osyXCIOQfRE>

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Eugenics Debate Text Set

Digital text: California's Dark Legacy of Forced Sterilizations (Con)

<http://www.cnn.com/2012/03/15/health/california-forced-sterilizations/index.html>

Link to PDF on The Ashley Treatment from her parents (Pro)

<http://pillowangel.org/At-Summary.pdf>

<http://pillowangel.org/Ashley%20Treatment.pdf>

Against Their Will (Con)

<http://extras.journalnow.com/againsttheirwill/parts/two/story1.html>

The majority opinion of Justice Holmes in Buck v Bell (Primary source)

<http://www.houseofrussell.com/legalhistory/alh/docs/buckvbell.html>

Video on the two types of sterilization

<http://www.youtube.com/watch?v=BjgtNHs5MQ4>

Facts about Hysterectomy (Con)

<http://www.hersfoundation.org/facts.html>

Eugenic Sterilization Laws (Con)

<http://www.eugenicsarchive.org/html/eugenics/essay8text.html>

Digital text on the eugenics movement: "Homo sapiens 1900" (Con)

<http://www.youtube.com/watch?v=x8Vttg25FmY&feature=related>

An article that discusses who has the right to have a baby (Pro)

Steinbock, Bonnie. "Reproductive rights and responsibilities." *The Hastings Center Report* May-June 1994: 15+. *Gale Science In Context*. Web. 7 Aug. 2012.

http://ic.galegroup.com/ic/scic/AcademicJournalsDetailsPage/AcademicJournalsDetailsWindow?failOverType=&query=&prodId=SCIC&windowstate=normal&contentModules=&mode=view&displayGroupName=Journals&li_miter=&currPage=&disableHighlighting=false&source=&sortBy=&displayGroups=&action=e&catId=&activityType=&scanId=&documentId=GALE%7CA15549772&userGroupName=gnlopacplus&jsid=5d6348f19ae9a83ef3e9750c080b5a7f

Should the mentally ill be on mandatory birth control or sterilized? (Pro/Con)

<http://socyberty.com/issues/should-the-mentally-ill-be-on-mandatory-birth-control-or-sterilized/>

Scientists debate China's law on sterilizing the carriers of genetic defects

<http://www.nytimes.com/1998/08/16/world/scientists-debate-china-s-law-on-sterilizing-the-carriers-of-genetic-defects.html?pagewanted=all&src=pm>

"In the patient's best interest? Revisiting sexual autonomy and sterilization of the developmentally disabled" (Pro)

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1071584/>

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Fighting Pollution – Can We Make a Difference? (Grades 4-8)

Preventing illegal dumping by tracking trucks

http://www.esa.int/esaKIDSen/SEMYP2WPXPF_Earth_0.html

Role of satellites in tracking pollution

http://www.esa.int/esaKIDSen/SEM2WKXJD1E_Earth_0.html

Famous “Keep America Beautiful” PSA

<http://www.youtube.com/watch?v=j7OHG7tHrNM>

Kids ecology corps describes various kinds of pollution, including water, air, etc.

<http://www.kidsecologycorps.org/our-environment/natural-cycles/water-pollution>

National Geographic review of causes of air pollution

<http://environment.nationalgeographic.com/environment/global-warming/pollution-overview/>

Quick ideas about fighting air pollution

<http://www.arb.ca.gov/knowzone/students/whatcha-doin/index.htm>

Air quality – history and what to do about improving it

<http://www.clean-air-kids.org.uk/airquality.html>

Germ

An article about how exposure to germs trains the immune system

<http://www.nytimes.com/2009/01/27/health/27brod.html>

An article on the importance of hand washing

http://kidshealth.org/teen/your_body/skin_stuff/handwashing.html

A book about germs

*Germ*s Make Me Sick! By Melvin Berger

Two articles about hand washing and soap, “Hooray for Hand-Washing!” and “Soap Stories”

http://portal.acs.org/portal/acs/corg/content?_nfpb=true&_pageLabel=PP_SUPERARTICLE&node_id=1758&use_sec=false&sec_url_var=region1&_uuid=b9bbb526-349d-4cb4-8ec1-9f6ee721ff31

An article on how the immune system works

<http://kidshealth.org/kid/htbw/immune.html>

A video about the harmful effects of antibacterial soap

<http://www.youtube.com/watch?v=wLObpTgJRkg&feature=related>

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Global Warming (Grades 4-8)

Environmental Defense Fund explains earth warming up

http://www.edf.org/climate/climate-facts-dangers-and-what-you-can-do?s_src=ggad.03.2012.control&gclid=CP2-oMfc9a4CFWcQNAodrzWVEw

EPA's student guide to climate change

<http://www.epa.gov/climatechange/kids/>

Student's environmental science project – a cartoon video explaining global warming

<http://www.youtube.com/watch?v=GBQ8-zEcE9w>

Global warming explanation

http://www.esa.int/esaKIDSen/SEMZ3LXJD1E_Earth_0.html

Threat of melting ice

http://www.esa.int/esaKIDSen/SEMFE07CS5G_Earth_0.html

Children of tomorrow sing about planet change

<http://www.youtube.com/watch?v=JwO8w9Ku-g0>

Argues the debate is not over about global warming

<http://abcnews.go.com/2020/Stossel/story?id=3751219&page=1#.T2ibycUgewQ>

Contest to 'debunk' global warming, with links to winning kids' entries

<http://www.wnd.com/2008/04/62598/>

Green Energy (Grades 4-6)

The pros and cons of solar energy

http://www.clean-energy-ideas.com/articles/pros_and_cons_of_solar_energy.html

An article on one negative effect of alternative energy sources, from Fox News

<http://www.foxnews.com/scitech/2011/11/05/wind-farms-disrupting-radar-scientists-say/>

National Geographic video on alternative energy

<http://video.nationalgeographic.com/video/player/environment/energy-environment/alternative-energy.html>

An article about President Obama's promotion of clean energy

<http://www.scholastic.com/browse/article.jsp?id=3756003>

An article about urban farms

<http://www.sciencenewsforkids.org/2008/10/farms-sprout-in-cities-2/>

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Nuclear Power

Transcript of President Eisenhower's speech to the United Nations proposing sharing nuclear materials to use for positive outcomes.

http://www.iaea.org/About/history_speech.html

The text has the link to the video "Nuclear Boy" embedded. It is also easily found at Youtube with the search "Nuclear Boy."

http://www.huffingtonpost.com/2011/03/17/japan-nuclear-crisis-cartoon_n_837190.html

Peterson, Scott, and Kelly Kissock. "Nuclear Energy: Does It Make Sense for the Environment?." *New York Times Upfront* (Vol. 138, No. 3). Oct. 10 2005: 32. SIRS Discoverer. Web. 05 Jul 2012.

White, David. "Japan Switches Off All Nuclear Plants; Fears Fall as Emissions Rise." *Social Studies for Kids*. 05 May 2012: n.p. SIRS Discoverer. Web. 05 Jul 2012.

"Explaining Nuclear Energy for Kids." *Washington Post*. 17 Mar. 2011. Web. 06 July 2012.

http://www.washingtonpost.com/lifestyle/style/explaining-nuclear-energy-for-kids/2011/03/15/ABhFsf_story.html

"NMAH | Three Mile Island: The Inside Story." *NMAH | Three Mile Island: The Inside Story*. N.p., n.d. Web. 06 July 2012.

<http://americanhistory.si.edu/tmi/index.htm>

"Nuclear Energy: It's All About Clean Living." *Nuclear Energy: It's All About Clean Living*. Jan. 1999: n.p. SIRS Discoverer. Web. 03 Jul 2012.

An article that discusses the Nuclear Debate with testimonials for and against nuclear power.

<http://www.economist.com/debate/overview/201>

"Two Cars in Every Garage and Three Eyes on Every Fish." *The Simpsons: Season 2, Episode 4*. Can be found on YouTube.

"Time for Change." *Pros and Cons of Nuclear Power*. Web. 06 July 2012. (This page is high on the Google search results and is flawed in many ways.)

<http://timeforchange.org/pros-and-cons-of-nuclear-power-and-sustainability>

A website created by the U.S. Energy Information Administration that gives an overview of energy sources.

http://www.eia.gov/kids/energy.cfm?page=nuclear_home-basics

See the end of this science text set list for an adapted article about nuclear power.

Pesticide Usage (Pro and Con)

The economics of crop yield outweigh the negative costs of using pesticides. (Pro)

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http://www.ehow.com/about_7237282_do-farmers-use-pesticides-crops_.html

The EPA explains why farmers use pesticides. (Pro)

<http://pesticides.supportportal.com/link/portal/23002/23008/Article/24924/Why-do-farmers-use-pesticides>

An article that looks at global markets as an explanation for the collapse of honeybee populations in the United States rather than environmental pesticides. (Pro)

<http://www.guardian.co.uk/environment/2010/jun/07/honeybee-collapse-stung-from-behind>

A chemical company presents the benefits of using pesticides in crop production. (Pro)

www.ppp.purdue.edu/Pubs/ppp-70.pdf

Two scientists from University of California-Berkeley Campus believe “cancer funds are chasing the red herring of pesticides.” (Pro)

<http://berkeley.edu/news/berkeleyan/1997/1119/pesticides.html>

A digital science salon (partnership with National Geographic) features the leading bloggers from a wide array of scientific disciplines. (Pro)

<http://scienceblogs.com/insolence/2012/06/26/what-do-polio-pesticides-and-cell-phone-radiation-have-in-common/>

Various news clips on the dangers of exposure to pesticides in our environment. (Con)

http://www.youtube.com/watch?v=TbZFPui2yo&feature=youtube_gdata_player

Examines the role that the EPA plays in restraining the use of dangerous pesticides and the importance of advocacy groups like Earthjustice. June 2012. (Con)

<http://earthjustice.org/blog/2012-june/better-living-through-chemistry-or-not>

Explores the dangers that Indigenous Mexican migrant farm workers face when exposed to harmful pesticides. (Con)

<http://saic.nativeweb.org/ayn/huichol.html>

Statistical data on the hazardous effects of exposure to pesticides. (Con)

<http://grassrootsgourmet.net/2008/11/20/pesticides-what-doesnt-kill-you-makes-you-stronger/>

Pages of images exposing the dangers of pesticides to human and animal populations. (Con)

http://images.google.com/search?q=pesticides&tbm=isch&pbx=1&site=images&csll=&action=&biw=1398&bih=702&sei=-EX2T_iHGO620AGuiMTVBg

Natural News claims that after Bayer’s neonic products were banned in France and Germany, bee populations began to rise again. Does not provide specific stats. (Con/Neither)

http://www.naturalnews.com/034678_honey_bees_colony_collapse_pesticides.html#ixzz1zng12msm

Suggestions on how to use beneficial insects to control harmful pests. (Con)

<http://insects.about.com/od/insectpests/p/attbeneficials.htm>

Promotes the use of natural pesticides from everyday supplies found in and around the home. (Con)

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<http://www.globalhealingcenter.com/effects-of-pesticides/effects-of-pesticides>

A graph illustrating crops pollinated by bees. (Con)

<http://conservationreport.com/2010/03/08/colony-collapse-disorder-increasing-costs-for-farmers/>

Organic and conventional beekeepers discuss Colony Collapse Disorder. (Nuanced)

<http://mobile.casttv.com/video/rxi1djl/colony-collapse-disorder-prevention-turns-out-to-be-easy-video>

A farmer discusses the struggles faced when trying to eliminate harmful pesticides from crop production. (Nuanced)

<http://www.youtube.com/watch?v=sRwg05M83Gk>

Two studies examine the effects of the pesticide neonicotinoid on the collapse of bee colonies. (Nuanced/Counter argument)

http://usnews.msnbc.msn.com/_news/2012/03/29/10921493-neonicotinoid-pesticides-tied-to-crashing-bee-populations-2-studies-find

Presents a chemical companies point of view on the benefits of using pesticides to manage crop production. (Pro)

<http://www.croplifeamerica.org/crop-protection/benefits/>

Science Times news article that investigates *scientists' quandaries about the alarming* and puzzling decline in *bee* populations in the United States and other parts of the world. March 29, 2012. (Nuanced/Counter argument)

<http://www.nytimes.com/2012/03/30/science/neocotinoid-pesticides-play-a-role-in-bees-decline-2-studies-find.html>

Chemical companies perspective on the use of neonicotinoids, a pesticide used in *crop protection* products for insect control. (Pro)

http://www.bayercropscience.com/bcsweb/cropprotection.nsf/id/EN_Neonicotinoids_Crop_protection_products_f_or_insect_control_2010?open&PrintPreview

Beekeepers share concerns about Colony Collapse Disorder. (Nuanced)

http://www.nytimes.com/2007/02/27/business/27bees.html?_r=1&pagewanted=all

News clip that presents two sides of the debate on the use of the pesticide neonicotinoid. (Nuanced)

http://cosmiclog.msnbc.msn.com/_news/2012/05/10/11647044-pros-and-cons-in-the-bee-debate#

An amateur beekeeper and journalist questions the validity that pesticides are responsible for the collapse of honeybee colonies. (Pro/Nuanced)

<http://starvingofftheland.com/2012/04/colony-collapse-and-me/>

Recycling (Grades 4-6)

An article about recycling: “*Recycling-Chemistry Can*”

http://portal.acs.org/portal/PublicWebSite/education/whatischemistry/scienceforkids/articles/CSTA_015171

A news clip that argues recycling is the “lazy” way of saving our planet

<http://www.youtube.com/watch?v=gVS3O5vxpJI&feature=related>

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An article on the problems with plastic and attempts to create eco-friendly plastics

<http://www.sciencenewsforkids.org/2011/07/plant-powered-plastics/>

An article that argues recycling is a waste of time, money and energy

<http://mises.org/daily/1911>

Discover Video- how plastic bottles are made

http://www.youtube.com/watch?v=T01i_vp2mJE&feature=youtube_gdata_player

YouTube video on recycling of water bottles

http://www.youtube.com/watch?v=YEGewENa6E&feature=youtube_gdata_player

Recycling (Grades 6-9)

(Courtesy of Joshua Hurley-Bruno, School of the Future)

Facts on the benefits of recycling

http://ecocycle.org/files/pdfs/why_recycle_%20brochure.pdf

Article arguing if recycling is worth the trouble and cost

<http://abcnews.go.com/US/story?id=91824&page=1#.T2i24cUgewQ>

The cons of recycling

<http://www.livestrong.com/article/124212-cons-recycling/#ixzz1cMpMKV6r>

Hidden costs of recycling (on a college student's blog)

<http://policyeconomics.blogspot.com/2007/12/hidden-costs-of-recycling.html>

Efforts to recycling, including pros and cons

http://www.cleveland.com/pdq/index.ssf/2008/09/are_all_your_recycling_efforts.html

Blog about trouble with trying to get rid of plastic – and its effects

<http://quakerpagan.blogspot.com/2008/12/whats-wrong-with-recycling-trouble-with.html>

Recycling gone to waste because trucks not separating trash

http://www.woai.com/content/troubleshooters/story/Recycling-gone-to-waste/Im2Cy5_yAkmlZyoMiTP1Ow.csp

Why it's beneficial to recycle

<http://ohiodnr.com/Home/why/tabid/9402/Default.aspx>

Sharks

A book about shark attacks

Shark Attacks by Patrick J. Fitzgerald

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A book about both sharks' danger and beauty
Sharks! From *Time for Kids*

A video about a shark detective
<http://video.nationalgeographic.com/video/player/kids/>

An article about the threat humans pose to sharks (see attached)
"People are More Dangerous than Sharks," adapted from an article by Charles Q. Choi

An article on the recent increase in shark attacks (see attached)
"Alarming Increase in Fatal Shark Attacks World-Wide: Science Cuts through the Hysteria for Answers," adapted from an article written by Dr. Douglas Fields

An article on the importance of sharks and the food web (see attached)
"Food Web Woes," adapted from an article by Emily Sohn

Thinning Ozone Layer (Grades 4-8)

Description of what the ozone is, and effects of ozone depletion
http://www.epa.gov/sunwise/kids/kids_ozone.html

European Space Agency satellite photos of holes in the ozone layer
http://www.esa.int/esaKIDSen/SEMY1LXJD1E_Earth_0.html

Good and bad ozone
<http://dnr.wi.gov/org/caer/ce/eeek/earth/air/badozone.htm>

How the damage to the ozone started
<http://dnr.wi.gov/org/caer/ce/eeek/earth/air/ozonlayr.htm>

What is the ozone hole?
<http://www.clean-air-kids.org.uk/ozonehole.html>

National Geographic article on thinning ozone layer and CFCs
<http://environment.nationalgeographic.com/environment/global-warming/ozone-depletion-overview/>

Dense fact sheet and video interview with arctic explorer on recovery of ozone layer
<http://www.theozonehole.com/fact.htm>

Science teacher argues that there is no hole in the ozone
<http://www.opposingviews.com/i/there-is-no-hole-in-the-ozone-layer>

Blog argues that hole in the ozone layer is a good thing
<http://blogs.telegraph.co.uk/news/janetdaley/100018432/newsflash-hole-in-ozone-layer-a-good-thing/>

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Water Pollution: Issues and Stances (Grades 4-8)

Effect of bottled water on pollution levels from National Geographic

<http://kids.nationalgeographic.com/kids/stories/spacescience/water-bottle-pollution/>

Types of water pollution and facts about water pollution

http://www.chewonki.org/cleanwater/water_pollution.asp

A forum on water pollution issues

<http://www.water-pollution.org.uk/>

Article about the difference between bottled water and tap water

<http://abcnews.go.com/2020/Health/story?id=728070&page=1#.T2ihCcUgewQ>

20/20 video on origins of bottled water – same as above article

http://www.youtube.com/watch?v=_3QBZac3MSY

Summary of dangers of tap water – from a water filter company

<http://www.reverse-osmosis-water-filter-guide.com/dangers-of-tap-water.html>

Wildfires (Grades 6-9)

A Smokey the Bear PSA from the 1980s

<http://www.youtube.com/watch?v=U6xMd0wSbZc>

Another Smokey the Bear PSA with Joanna Cassidy with provocative messaging

<http://www.youtube.com/watch?v=tXcrbpMNvTs>

How foresters set prescribed fires

<http://videos.howstuffworks.com/science/wildfire-videos-playlist.htm#video-37838>

A newscast about the effect of ‘cooling fires’

<http://videos.howstuffworks.com/science/wildfire-videos-playlist.htm#video-3497>

Role of fire control and effect on ecosystem of American Indians, includes bibliography

http://www.wildlandfire.com/docs/biblio_indianfire.htm

USNews Report on nitrogen cycle and how it is affected by forest fires

<http://www.usnews.com/science/articles/2010/08/10/forest-fires-help-power-the-nitrogen-cycle>

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The Pros and Cons of Nuclear Power



A nuclear power station with adjoining cooling vent.

Nuclear power stations have been making electric power for over 50 years. Nuclear power is very efficient. For example, one of those small uranium pellets can produce as much electricity as 150 gallons of oil. Just one nuclear station can provide enough power for a city. Many people see nuclear power as an alternative energy source.

Unlike fossil fuel-fired power plants, nuclear reactors do not produce air pollution or carbon dioxide while operating. They contain cooling towers that vent water vapor into the air.

The risk of an accident at a nuclear power station is very small due to the numerous safety systems, the training and skills of the operators, and the oversight of the Nuclear Regulatory Commission. A large area surrounding nuclear power plants is restricted and guarded by armed security teams. U.S. reactors have containment vessels that are designed to withstand extreme weather events and earthquakes.

According to Oliver Morton, Energy and Environment Editor at *The Economist*, nuclear power retains the ability to provide copious amounts of reliable electricity without causing dependence on imported fossil fuels. He argues that, "Those who wish to see global warming halted have to recognize that if nuclear power were abolished today and replaced by other technologies, the world would emit an extra 2 billion tons of carbon dioxide every year."

Proponents claim that nuclear power has caused far fewer accidental deaths per unit of energy generated than other major forms of power generation. Energy production from coal, natural gas, and hydropower has caused far more deaths due to accidents.

However, opponents of nuclear power state that the risks outweigh the rewards. They say that nuclear power poses many threats to people and the environment. These threats include health risks and environmental damage from uranium mining, processing and transport, the risk of nuclear weapons proliferation or sabotage, and the unsolved problem of radioactive nuclear waste.

An uncontrolled nuclear reaction in a nuclear reactor can potentially result in widespread contamination of air and water with radioactivity for hundreds of miles around a reactor. Some serious nuclear and radiation accidents have occurred. Nuclear power plant accidents include the Chernobyl disaster (1986), Fukushima Daiichi nuclear disaster (2011), and the Three Mile Island accident (1979).



The nuclear reactor in Chernobyl after the disaster. From 1986 to 2000, 350,400 people were evacuated and resettled from the most severely contaminated areas of Belarus, Russia, and Ukraine.

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Moreover, nuclear power plants can be used to build nuclear weapons. According to Tom Burke, founding director of E3G (Third Generation Environmentalism), “Atoms cannot be made to work for peace without making them available for war.”

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Adapted from:

- **“Explaining Nuclear Energy for Kids,” *The Washington Post* (March 17, 2011)** http://www.washingtonpost.com/lifestyle/style/explaining-nuclear-energy-for-kids/2011/03/15/ABhFsfl_story.html
- ***What is Nuclear Energy?***
A website created by the U.S. Energy Information Administration that gives an overview of energy sources.
http://www.eia.gov/kids/energy.cfm?page=nuclear_home-basics
- **“Nuclear Power,” *The Economist*, (July 4, 2012).**
An article that discusses the Nuclear Debate with testimonials for and against nuclear power.
<http://www.economist.com/debate/overview/201>

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Rain Forest Wood

Rain forests are home to very diverse plant life, and in many cases rain forests are the only places to find certain types of wood. These woods have stand-out characteristics, such as rare beauty, density (very heavy or very light), exceptional strength, unusual color, etc. These woods are used for a variety of purposes depending on the characteristics of the wood. For example, balsa wood is very light, so it is good for coring boats and building models. A dense wood such as mahogany is desired for its dark color and its strength -- good for furniture or decoration.



Fine furniture
made from
mahogany

Teak is one of
the hardest,
most rot-resistant
woods, so it is
often used as
wood on fancy
boats (trim,
windowsills,
paneling, interior,

etc.), where it will resist water and retain its strength.

Teak boat decking



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Whatever use, there will be a wood that will suit it best, and many times, that wood comes from a rainforest. Because fine wood products are in great demand in Europe and the United States, deforestation of the rain forest cannot be stopped.

Adapted from www.blurtit.com and
<http://library.thinkquest.org/27257/uses3.html>

DEFORESTATION IN MADAGASCAR for Kids



© WildMadagascar.org

Airplane view of deforestation-induced erosion in Madagascar

Deforestation in Madagascar is largely the result of three activities: slash-and-burn agriculture, logging, and the production of fuelwood and charcoal for cooking fires.

Slash-and-burn agriculture

Slash-and-burn agriculture, known locally as tavy is an important part of Malagasy culture and the Malagasy economy. Tavy is mostly used for converting tropical rainforests in Madagascar into rice fields. Typically an acre or two of forest is cut, burned, and then planted with rice. After a year or two of production the field is left unused for 4-6 years before the process is repeated. After 2-3 such cycles the soil is exhausted of nutrients and the land is likely colonized by scrub vegetation or grass. On slopes, the new vegetation is often insufficient to anchor soils, making erosion and landslides a problem.

Tavy is the most expedient way for many Malagasy to provide for their families, and among people whose day-to-day subsistence is in question there is little concern for the

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long-term consequences of their actions. From their perspective, as long as there is more forest land freely available for clearing, you might as well use the land before a neighbor does. Tavy for rice also has spiritual and cultural ties that transcend the economic and nutritional value of rice as a crop.

Logging for timber

Logging for timber is especially a problem in the rainforests of eastern Madagascar, particularly on the Masoala peninsula. The high value for Malagasy hardwoods (mostly ebony and rosewood which may fetch \$2,000 a ton in international markets) makes illegal logging a significant problem in some protected areas.

Fuelwood and charcoal production

The endemic spiny forests of Madagascar are being cut at an alarming rate for charcoal production. In eking out a living by selling little piles of charcoal along roads in southwestern Madagascar, local people turn towards the nearest plant source which in this case is often the magnificent *Alluaudia* tree.

The deforestation debate

Humans are the biggest threat to the world's rainforests. Large areas are cut down every minute to provide fuel, wood or paper, or cleared so that the land can be used for farming, mining or cattle ranching. Here are some of the arguments for and against deforestation (the cutting down of rainforest trees). Colour the statements 'for' deforestation in one colour and the statements 'against' in another. Which do you think is the most powerful argument for each side?

About a quarter of our medicines come from plants. But, there are many undiscovered species in the rainforest that might one day provide a cure for deadly diseases.

The logging industry provides work for millions of people and governments in poor countries depend on the money it creates.

Rainforests are destroyed by nature – flooding, hurricanes, and so on – so we're better off making use of their products than seeing them wasted.

Many of the areas that have been cleared have been replanted with new trees.

Deforestation is destroying the habitats of animals, many of which are becoming extinct. It is also destroying land belonging to the native human population.

Many people rely on rainforest wood for building, as well as meat and crops from farmed rainforest land.

With no trees to anchor it down, soil is eroded by heavy rain. Silt from the soil is washed into rivers, polluting them.

We get a lot of our food from the rainforest – for example bananas, coffee, rice, potatoes, nuts, oranges and figs.

Deforestation adds to the greenhouse effect, as rainforest trees help to control the climate. The machinery used also adds to carbon emissions.

Even if trees are replanted, they take years to grow back.

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How to Prevent Deforestation

Tsunamis, hurricanes, floods, pollution - all these are the ill effects of deforestation. Read on to know how to prevent deforestation and restore the green cover of our planet...



Owing to growth in population coupled with human greed, there has been widespread cutting of trees, all over the world. The trees, plants and forests are being cut, to make space for human habitation, industries, livestock pastures, etc. This practice is what is termed as deforestation.

In recent times, the ill effects of deforestation have come to light in the form of various environmental catastrophes taking place all over the world, such as tsunamis, hurricanes and earthquakes. Not to mention, how great a contributing factor deforestation is to air and water pollution as well as soil erosion. That's why, it is necessary that awareness should be spread about the fact that if the human race has to survive, the ecology and the environment have to be maintained and not be tampered with, in any form. Various steps should be taken, both at the individual and the governmental level, to prevent deforestation from happening.

Grow Trees

To reverse the damage that has been done due to deforestation, grow more trees. Individuals should start this initiative by growing trees in their own backyards. Also, cutting of trees should be checked. If at all trees need to be cut, it should be old and dead trees which are going to collapse anyway, while the younger ones should be allowed to grow. The government on its part should enforce a ban on cutting of trees. Fines and punishments should be imposed if rules to safeguard trees are broken by anybody.

Spread Awareness

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The government should stage campaigns and spread awareness on how deforestation has affected humans adversely. Presentations should be made in schools and colleges on safeguarding forests. Children should be involved in "save the forests" campaigns, because if such beliefs are ingrained from childhood itself, the chances of them being carried forward to adulthood, increase manifold. Along with the Government, various non governmental and community organizations, should take it upon themselves, to involve the people in putting an end to cutting of trees.

Recycle

Recycle the products made from paper, plastic and glass that you use, such as shopping bags, bottles, books, etc. Also, buy products that are recycled. It is not just households, but even businesses, who should focus on using recycled products, because if everybody starts doing this, it will reduce the need for raw materials considerably and thus, less trees will be cut. On an individual level, people should completely give up on using products that require trees to be cut. Another thing that people can do is to avoid using firewood and coal in their fireplaces. No doubt, this is an intelligent way to reduce your carbon imprint on this earth and prevent global warming and deforestation as well.

Follow Crop Rotation

Farmers should make use of environment savvy techniques like crop rotation. Crop rotation involves using the same piece of land to grow two different kinds of crops, instead of growing the same in two different pieces of land. This saves land plus makes it more fertile too, lessening the need to convert forest land into farmland.

Adopt Vegetarianism

Be a vegetarian. If you cannot give up on meat, reduce its intake to the minimum, as a whole lot of crops and plants get wasted in feeding the animals. When animals are left to graze in the forests, plants and trees get destroyed. So, as much as possible, make your diet from fruits and vegetable. This will save the environment and keep you in the best of health too.

Whether it is food to eat, oxygen to breathe or beauty to see, humans derive all these things and pleasures from trees and forests. That's why, following the above suggested tips on preventing deforestation and saving the environment are very necessary. Saving trees means lesser catastrophes and lesser pollution, both of which are beneficial for the survival of the human race. Ultimately, it is individual human effort and an undeterred

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strive to change things on part of each one of us, that will yield the desired results in this direction!

By [Aastha Dogra](#)
Published: 5/24/2011

Deforestation



Photograph by Tomas Munita/AP Photos

Modern-Day Plague

Deforestation is clearing Earth's forests on a massive scale, often resulting in damage to the quality of the land. Forests still cover about 30 percent of the world's land area, but swaths the size of Panama are lost each and every year.

The world's rain forests could completely vanish in a hundred years at the current rate of deforestation.

Forests are cut down for many reasons, but most of them are related to money or to people's need to provide for their families. The biggest driver of deforestation is agriculture. Farmers cut forests to provide more room for planting crops or grazing livestock. Often many small farmers will each clear a few acres to feed their families by cutting down trees and burning them in a process known as "slash and burn" agriculture.

Logging operations, which provide the world's wood and paper products, also cut countless trees each year.

Loggers, some of them acting illegally, also build roads to access more and more remote forests—which leads to further deforestation. Forests are also cut as a result of growing urban sprawl.

Not all deforestation is intentional. Some is caused by a combination of human and natural factors like wildfires and subsequent overgrazing, which may prevent the growth of young trees.

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Deforestation has many negative effects on the environment. The most dramatic impact is a loss of habitat for millions of species. Seventy percent of Earth's land animals and plants live in forests, and many cannot survive the deforestation that destroys their homes.

Deforestation also drives climate change. Forest soils are moist, but without protection from sun-blocking tree cover they quickly dry out. Trees also help perpetuate the water vapor back into the atmosphere. Without trees to fill these lands can quickly become barren deserts.

Removing trees deprives the forest of portions of its sun's rays during the day and holds in heat at night. This extreme temperatures swings that can be harmful to plants. Trees also play a critical role in absorbing the greenhouse warming. Fewer forests means larger amounts of the atmosphere—and increased speed and severity of. The quickest solution to deforestation would be to simply. Though deforestation rates have slowed a bit in recent make this unlikely to occur.

A more workable solution is to carefully manage forest clear-cutting to make sure that forest environments remain intact. The cutting that does occur should be balanced by the planting of enough young trees to replace the older ones felled in any given forest. The number of new tree plantations is growing each year, but their total still equals a tiny fraction of the Earth's forested land.

Highway 1 through the Costa Rican rain forest is subject to mudslides. Above, a truck makes it way along a new road, after the earlier road (right) was washed out by Hurricane Cesar. Photo Courtesy of Dr. Hays Cummins (<http://jrscience.wcp.mu.ohio.edu/html/index.html>)

cycle by returning water roles, many former forest

canopy, which blocks the disruption leads to more and animals.

gases that fuel global greenhouse gases entering global warming.

stop cutting down trees. years, financial realities

resources by eliminating



The Effects of Humans

From Grolier's *The New Book of Knowledge*

For centuries, humans have relied on rain forests for a variety of products. Foods such as tomatoes, peppers, corn, rice, coconuts, bananas, coffee, cocoa, tapioca, beans, and sweet potatoes all originally came from the rain forest. Many civilizations have exploited the timber in rain forests and cleared the land for farms. Some preliterate tribes have actually lived in the rain forests for thousands of years. Today people rely on tropical rain forests for a variety of everyday products: paper (7 percent of all paper pulp

comes from the rain forest); rubber (used in tires and other products); wax (used in plastics); mahogany and teak (used in wood products such as furniture); and many other items.

Destructive Activities

Unfortunately, human activities have taken a toll on the rain forest. Some of the most-destructive practices are discussed below.

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Farming. In some areas of the world, the practice of *shifting cultivation* has destroyed parts of the forest. In this type of farming, a farmer clears an area of the forest, plants crops for two or three seasons, and then moves on to a new area of the forest. This can lead to a slow, progressive deforestation of the area. In many parts of the world, this type of farming has increased as people move out from overcrowded cities to farm small patches of land. On the island of Java, the forest has been almost totally cleared and replaced with rice fields or plantations of such crops as rubber. Commercial farming practices, which clear even larger areas of land, can also quickly lead to rain-forest destruction.

Cattle ranching also poses a danger to rain forests. In some parts of the world, entire forests are cleared to create pastures for grazing.

Logging. In recent years, the demand for exotic woods found in the rain forest has increased dramatically. This has led to the destruction of forests in Brazil, Central America, and Malaysia, and has endangered temperate rain forests in British Columbia and Alaska. In Alaska, loggers in the Tongass National Forest have cut down more than 1 million acres (405,000 hectares) of virgin rain forest. But a federal court ruled in April 2001 that the U.S. Forest Service must consider designating more wilderness areas in the Alaskan rain forest. This decision may help to slow the rate at which trees are currently being depleted there.

Other activities. Mining, too, is a problem. Rain-forest soils can be rich in iron, bauxite (the raw material for aluminum), or other minerals, but mining operations can destroy the rain forest in the search for these minerals. Finally, wars, natural disasters, and construction projects (such as for dams and roadways) may destroy the forest.

Destruction Aftermath

The effects of rain-forest destruction are far-reaching, and in many cases are impossible for scientists to assess and to predict.

Soil and erosion. Because the soil in most rain forests is relatively infertile to begin with, once the plant layer is removed, the soil can quickly lose virtually all of its ability to support plant life. Some soils turn into a type of hard clay called *laterite*. Removal of a rain forest's vegetation can also lead to extensive erosion, as the soil, without plants to anchor it, is quickly washed away by rain and wind.

Flora and fauna. Destruction of the rain forests also limits biodiversity. As stated earlier, scientists believe that rain forests contain three-fourths of all the known species of plants and animals on Earth. Rain forests may also contain many species that have yet to be discovered, some of which could have medicinal value. Pharmaceutical companies are rushing to search rain forests for any undiscovered species of plants that might be useful in treating diseases.

Climate. Rain forests play a role in the world's climate. They help regulate Earth's hydrologic (water) cycle, the process whereby water that evaporates from trees and plants falls back to Earth as rain. When a forest is destroyed, the cycle is changed. The result may be droughts, floods, and soil erosion in areas that would not normally experience such events. When forests are destroyed, the ability of the surface of Earth to reflect light also changes. This, in turn, alters the patterns of rainfall, and wind and ocean currents.

Devera Pine

The Positive and Negative Consequences of Deforestation

By [*Nathalie Fiset*](#)



Earth and the lives of everything that depends on it - from the smallest bacteria to the largest sea creatures - rest on a delicate matter and that is balance. A single, seemingly harmless disturbance in this balance has consequences that are both beneficial and disadvantageous. One of these is deforestation.

Deforestation has always been a practice of many developing communities and has contributed greatly to civilization as we know it today. Unfortunately, much of the ill effects of deforestation is caused by greed, bad agricultural practices and government neglect.

Why forests are important -

Other than for their beauty, forests are highly responsible in keeping and sustaining global ecosystems. In fact, much of the quality of life we enjoy, we owe to the forests. It is also the home of more than half of all creatures and organisms in this planet. From food to life-saving medicines, forests give mankind a variety of gifts that contribute much to our quality of life.

The positive consequences of deforestation -

Depending on the needs of the social group concerned, deforestation has made it possible for communities to be built. Forests make way for residential houses, office buildings and factories. Governments are able to build roads to make trade and transport easier and therefore more convenient to residents.

Deforestation can also mean the conversion of forest land to productive land for agricultural uses. This results in better and more abundant production of food and materials, virtually eradicating periods of want and lack.

Economically, deforestation has contributed much in giving many communities the opportunity to make positive changes in their lives.

The negative consequences of deforestation -

Unfortunately, the negative consequences of deforestation far outweigh its positive effects. Here are a few of them:

1. Exposing soil to heat and rain. When forests are cleared, soil cover, which consists mainly of vegetation, is removed as well. This exposes the bare soil to extreme conditions produced by the sun's heat and rainwater.

With these activities alternating, the soil quickly compacts. As rainwater flows, it will wash out the nutrients and other organic materials that make the soil rich and fertile. Add to that the frequent activities of tilling, cropping and grazing which gradually results to the degradation of the soil's quality.

These practices are specially a concern in areas where forest zones are drier. Agriculture practice on top of deforestation can result to the desertification of many areas. Desertification is also a direct result of the demand for the soil to produce more (as a consequence of the increase in human population), thereby decreasing to a significant degree the land's carrying capacity.

2. Flooding. Deforestation can result to watersheds that are no longer able to sustain and regulate water flows from rivers and streams. Trees are highly effective in absorbing water quantities, keeping the amount of water in watersheds to a manageable level. The forest also serves as a cover against erosion. Once they are gone, too much water can result to downstream flooding, many of which have caused disasters in many parts of the world.

As fertile topsoil is eroded and flooded into the lower regions, many coastal fisheries and coral reefs suffer from the sedimentation brought by the flooding. This results to negative effects in the economic viability of many businesses and fatalities in wildlife population.

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3. Non-suitability of deforested areas for conversion. Most of the areas that have undergone deforestation are actually unsuitable for long-term agricultural use such as ranching and farming. Once deprived of their forest cover, the lands rapidly degrade in quality, losing their fertility and arability.

The soil in many deforested areas is also unsuitable for supporting annual crops. Much of the grassy areas are also not as productive compared to more arable soils and are therefore not fit for long-term cattle grazing.

4. The displacement of indigenous communities and their traditional way of life. When governments decide to offer forests for deforestation mainly to open up areas for 'civilized' communities, access to forest resources by indigenous peoples are ignored. In fact, indigenous peoples are hardly included in economic and political decisions that directly affect their lives. This encroachment ignores their rights as much as it takes away the resources that their ancestors have bestowed upon them.

5. The loss in the number of biodiversity. This is probably the most serious consequence of deforestation. Put simply, it means the destruction and extinction of many plant and animal species, many of whom remain unknown and whose benefits will be left undiscovered.

Each year, as deforestation continues, much of the wilderness from which we benefit and would have continued to benefit from will be lost forever. With it are the millions of chances in the form of plants and wildlife that could bring us many economic and medical solutions to pressing problems we currently face.

While it's true deforestation has brought with it opportunities to improve our lives, we have not mastered the right kind of responsibility that goes with having control over our planet's resources. As a result, we and all the other creatures on this planet suffer greatly from the consequences of our actions.

Nathalie Fiset M.D. is a family doctor, a certified hypnotherapist and an internet marketer. She is also a mother of four. Her passions are medicine, hypnosis, internet marketing, her family and helping others, among others!

For more information now go to: [<http://www.solutionstoearthdestruction.com>]

[<http://www.stoearthdestruction.com/Consequence-Of-Deforestation.html>]

Article Source: http://EzineArticles.com/?expert=Nathalie_Fiset

What are the Pros and Cons of Deforestation?

<http://debate.yukozimo.com/pros-and-cons-of-deforestation/>

One of the major disadvantages of deforestation is that it is one of the [primary causes of the greenhouse affects](#). Deforestation means the process of cutting down all of the trees and other plants in an area, generally in forests. As trees play an important role in the environment as well as in the survival process of human being and other organisms, deforestation can affect the whole world in numerous ways.

Photosynthesis process

Trees and plants release oxygen and remove the carbon dioxides from the environment during the photosynthesis process. Thus decreasing the number of trees can lead to an increased amount of carbon dioxide gases. It is one of the primary greenhouse gases and can contribute to the greenhouse affect as well as towards [global warming](#). In fact, statistics prove that about [20% of the current global warming is the direct result of deforestation](#).

Sea level will rise

If this continues, ice and glaciers around the world will melt and the sea level will rise, which can lead to different kind of disasters. Another disadvantage of deforestation is that [the water cycle of the earth can be affected by it](#). Trees play an important role by extracting ground water with their roots and then releasing it into the surrounding atmosphere.

Flooding and land slides

If this process is disturbed, it can lead to soil cohesion which can eventually lead to flooding. Deforestation can also increase the rate of soil loss to a great extent. Deforestation also has a vast affect on the ecology. A number of animals, birds, insects and other organisms depend on the trees and plants for habitat, food and other purposes. Deforestation can result in a food scarcity, loss of their natural habitats or even possibility extinction in some cases.

Deforestation = money + agricultural land

However, there are few advantages of deforestation. The trees and plants being cut are used for different purposes, such as producing wood, papers and other necessities. Forest land can be freed up for development, agricultural purposes and [palm oil plantation](#). Deforestation also provides a huge source of revenue for governments in terms of taxes and fees, especially in developing countries.

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Pros and Cons of Deforestation

Posted By [admin](#) On August 2, 2008 @ 4:11 pm In [Deforestation](#) | [Comments Disabled](#)

Pros and Cons of Deforestation

Deforestation is a big topic when we talk about the environment, [global warming](#), climate change, and all of those related topics. These are important topics, and we will have to change the way we live our lives, if we want to keep them. However, few things are truly black and white. Could it be that deforestation, the current big challenging thing for the environment, has positives and negatives? Could it have benefits and consequences?

There are always two sides to every story, of course, and [deforestation](#) is no exception.

One problem with trying to stop deforestation in developing countries is that the developed countries cleared forests right and left in setting up their countries. The reason we're talking to other countries about deforestation now is that we did not know about the environmental hazards before, or understand what that meant. Now we do, and it is essential that the deforestation of the Amazon rain forest be stopped.

But we have a credibility problem, because it seems like the big, industrialized (and largely white) countries are coming in and telling the poor South Americans what to do. There may be a little of that going on, but mostly, we're really concerned about the deforestation, and we have that credibility problem.

Not only do we not sound particularly sincere; these people benefit from deforestation. They have clear land to raise cattle, farm, build homes, and build roads. As far as they're concerned, it's "their" forest, and they're doing what it takes to improve their lives.

Yes, there are many negative consequences. In addition to the climate issues, soil erodes and nutrients are lost, so that the ground quickly becomes unusable. Lack of trees to hold water and support watersheds results in floods, which can cause landslides. On top of these difficulties, indigenous people, plants and animals are driven out, and many plants and animals may become extinct.

It is definitely not a good situation, and even the "benefits" that the local residents receive are paltry in comparison to what they lose. But they believe that they have the right to make the decision, and so far they see no other viable solutions. Stopping deforestation and reforesting the area depends on finding a way to offer them more, for not tearing down the trees, than they get by doing it. And the offer will have to appear as more to them, not just to the countries helping them find solutions.

It's hard to find a topic, particularly a global topic, with more diverse views. Many environmentalists blame governments for not protecting the rain forests, while the governments themselves are busy just trying to hold everything together with their limited resources. They're not able to take on global warming and rain forest deforestation. They don't have the leisure of being able to worry about the whole world, because they have more than they can do just to make sure their own countries don't collapse under the weight of the economic and other problems plaguing the area.

Read more about Deforestation:

- [What You Must Know About Deforestation](#) - August 29th, 2008
- [What Is Deforestation?](#) - August 26th, 2008
- [What Causes Deforestation?](#) - August 23rd, 2008
- [Understanding Amazon Deforestation](#) - August 20th, 2008
- [The History of Deforestation](#) - August 17th, 2008
- [Five Tips For Preventing Deforestation](#) - August 14th, 2008
- [How Deforestation Affects Us](#) - August 11th, 2008
- [How Can We Stop Harmful Deforestation?](#) - August 8th, 2008
- [Benefits of Deforestation](#) - August 5th, 2008

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'Boom and bust' of deforestation

By Richard Black
Environment correspondent, BBC News



ALEXANDER LEES

The Amazon forest may be worth more alive than dead, researchers say

Cutting down Amazon forest for cattle and soy does not bring long-term economic progress, researchers say.

A study of 286 Amazon municipalities found that deforestation brought quick benefits that were soon reversed.

Writing in the journal *Science*, the researchers say the deforestation cycle helps neither people nor nature.

They suggest that mechanisms to reward people in poorer countries for conserving rainforest could change this "lose-lose-lose" situation.

Jumbled paths

The Brazilian government has long had a twin-track approach to the Amazon, which contains about 40% of the world's remaining rainforest.

While the land development agency Inbra settles people in the region as a way of giving them

land and livelihoods - a policy that dates from the 1970s - the environment ministry is trying to reduce the rate of deforestation. Last year the environment ministry named Inbra as the country's worst illegal logger.

“ Reversing this pattern will hinge on capturing the values of intact forests ”

Andrew Balmford, Cambridge University

[Nature loss 'dwarfs bank crisis'](#)

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The Science study suggests that the settlement and expansion policy is not producing real benefits for people.

Ana Rodrigues and colleagues assessed the development status of people in 286 municipalities using the UN's Human Development Index (HDI), which combines measures of standard of living, literacy and life expectancy.

Some of the municipalities were in areas of virgin forest.

Others had already lost all their trees, and some were in the process of being deforested.

Areas in the initial stage of deforestation yielded HDI scores above the average for the region. But once the period of deforestation had passed, scores returned to the values seen in areas that had not yet been logged.

"It is generally assumed that replacing the forest with crops and pastureland is the best approach for fulfilling the region's legitimate aspirations to development," said Dr Rodrigues

"We found although the deforestation frontier does bring initial improvements in income, life expectancy, and literacy, such gains are not sustained."

The "boom and bust" pattern was the same for each of the three aspects of the HDI, showing that even a straight economic benefit was not maintained.

REDD dawn

As the study emerged, UN climate negotiators are meeting in Bonn to discuss aspects of a follow-on treaty to the Kyoto Protocol, which is supposed to be finalised by the end of the year.

One of the aspects of the new treaty will be a mechanism that rewards local communities for keeping carbon-absorbing forests intact - a mechanism known as REDD (Reducing Emissions from Deforestation and forest Degradation).



Soy plantations did not provide long-term benefits in this study

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Andrew Balmford, a co-author of the new study, said REDD and other proposals could change the current situation, which he described as disastrous for local people, wildlife and the global climate.

"Reversing this pattern will hinge on capturing the values of intact forests... so that local people's livelihoods are better when the forest is left standing than when it is cleared," said the Cambridge professor of conservation science.

"Discussions being held in the run-up to this December's crucial climate change meeting in Copenhagen... offer some

promise that this lose-lose-lose situation could be tackled, to the benefit of everyone - local Brazilians included."

The research was possible only because Brazil has good data on human development and on deforestation, which these days is measured by satellites.

But Ana Rodrigues believes the conclusions probably hold true for other countries stocked with tropical forests in southeast Asia or west Africa.

"I would be very surprised if we didn't see this boom and bust pattern emerging in these areas as well," she told BBC News.

President Lula is currently debating whether to ratify a bill that would grant legal status to illegal settlers and loggers in the Amazon region.

Environmentalists say the bill would increase the rate of land-grabs, with a knock-on rise in illegal logging likely.

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[Bumpy road to sustainability](#)

[The Amazon in graphics](#)

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**The Deforestation of the Amazon:
A Case Study in Understanding Ecosystems and Their Value**

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Biological diversity is the key to the maintenance of the world as we know it.... Eliminate one species, and another increases to take its place. Eliminate a great many species, and the local ecosystem starts to decay.... How much force does it take to break the crucible of evolution?

--E.O. Wilson, *The Diversity of Life*

I. INTRODUCTION

In a crowded market in the Brazilian Amazon, a heated discussion develops between a farmer, a logger, and an environmentalist near the booth where the farmer is selling his crop.

"I just don't know how I am going to pay for this fertilizer," says Marco, a disgruntled peasant farmer growing beans in a cleared forest pasture. "This is only my second year of farming in the area, but already the crops are growing poorly, and it is hard to get rid of the weeds. They want \$300 per hectare for fertilizer and pesticides, but the land is not worth that much money. All I can afford is the \$70 per hectare to clear more forest."

"But when you do cut the forest, you usually just burn the logs," replies Antonio, a local logger. "It would be a better use of the land for me to log the valuable trees."

"Why is logging better than clearing?" asks Carl, an environmentalist from Rio de Janeiro visiting to gather firsthand accounts of land uses in the Amazon. "Can't you see the true value of the forests around you? We are standing in the most biologically diverse region of the world, and all you complain about is money? We rely on these forests for oxygen, medicines, and spiritual benefits. Besides, don't these species have a right to exist beyond their value to humans?"

"Try feeding five children with spiritual benefits, Carl" Marco snaps. "Look at how much land is out here. Whether or not I clear forests will not make a big difference. Besides, we have a right to develop our natural resources."

"I agree with you, Marco," adds Antonio. "Forests grow back; they always have."

II. BACKGROUND

Nowhere on earth is the threat of biological impoverishment because of deforestation greater than in the Amazon Basin of South America. The Amazon supports approximately 300 million hectares of tropical forest, the largest single area of tropical forest communities in the world (Fig. 2). Estimates of global biodiversity point to the tropics as the source of 50 to 90% of all species on Earth (Wilson 1992); the richest forests often support over 300 tree species per hectare, approximately the same number of tree species in all of North America.

Recent estimates of deforestation suggest that between 1 to 3 million hectares are being cleared annually in the Amazon Basin (Laurence 1997; Fig. 3). Based on estimates of 1% annual tropical forest loss, the Amazon may be losing as many as 11 to 16 species per day (Wilson 1989), and the resulting ecosystems are often highly degraded (Buschbacher 1986).

The deforestation of Amazonia presents a challenging study of the interactions among people, their values, and the environment.

- Is deforestation in the Amazon any different than what occurred in industrialized Europe and North America centuries past?
- Should Amazonians develop their lands as they see fit?
- Do peasant farmers actively clearing forests value their environment any differently than world conservation organizations, you, or I?

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- What does the world stand to lose by watching the destruction of tropical forests?

These are some of the most hotly debated environmental questions today, leading to several international conventions like the recent United Nations Convention on Biodiversity at the Rio de Janeiro "Earth Summit" in 1992.

Factors leading to rapid tropical deforestation

Why are tropical forests being cleared in the Amazon Basin at such an alarming rate? Historically, deforestation has been caused by the interaction of many factors, seven of which are presented here for simplicity:

1. abundant forest resources
2. the need for peasant farmers to earn a livelihood
3. Brazilian government policies to construct highways, subsidize agriculture, and relocate farmers into the forests
4. the cattle industry's forced manipulation of peasant farmer land rights, and the marginalization of these farmers to the frontier
5. land speculation
6. rapid degradation of pastures due to poor soil quality and the costs of reclamation
7. oversupplies of beef and timber leading to price deflation and debt with banks in industrialized nations. Large debt, in turn, exacerbates timber exports.

In the 1940s Brazil began a national development program for the [Amazon Basin](#). Then-president Getúlio Vargas suggested that "The Amazon, under the impact of our will and labor, shall cease to be a simple chapter in the history of the world, and made equivalent to other great rivers, shall become a chapter in the history of human civilization.... Everything which has up to now been done in Amazonas, whether in agriculture or extractive industry... must be transformed into rational exploitation" (quoted from Hall 1989). Ironically, Vargas was correct that the Amazon shall cease to be a simple chapter in world history: international debt, rapidly degrading soils, the rapid loss of biodiversity, and the loss of human lives over bitter land disputes all underscore high tensions in this region. Vargas' national vision set into motion the establishment of several government programs, including the Superintendency for the Economic Valorization of Amazonia (SPVEA) in 1953, the Superintendency for the Development of Amazonia (SUDAM) in the 1966, and the National Institute for Colonization and Agrarian Reform (INCRA) in the 1971. In the 1960s, "rational exploitation" meant cattle--millions of them. The Brazilian government and several other foreign nations, including the Johnson Administration in the US, favored the development of cattle ranching in the Amazon to generate revenue during a period of high world beef prices as well as a means to eliminate world hunger (Hall 1989). Road projects, such as the Trans-Amazon Highway, were promoted in 1970 to open up commerce. Subsidies sponsored by SUDAM often granted 50% tax exemptions for investments in agriculture and livestock in the Amazon. By 1974, these subsidies had increased to 100% (Hall 1989). Indeed, a representative of the American company, Swift Armour, optimistically predicted that the Amazon Basin "was destined to be the great meat exporting center of the world" (quoted from Hall 1989).

Throughout the 1970s INCRA established programs to take advantage of newly developed highways to translocate hundreds of thousands of Brazilian citizens from northern and eastern states westward into the Amazon. The idea was analogous to homesteading on the American frontier in the 19th century. People moving to the frontier were given land practically for free so long as they showed evidence of "productive use," which, unfortunately meant clearing the forest for agriculture or pasture. These people represented mainly a class of peasant farmers, who lacked the financial support of Brazil's banks to start their own large-scale cattle or agricultural operations. Consequently, they practiced local forms of agriculture, the most popular of which has been slash-and-burn agriculture (Fig. 4). A typical slash-and-burn program involves cutting a small patch of forest, usually 3 to 4 hectares, burning the vegetation, perhaps after selling a minor fraction of timber, and growing and harvesting 2 to 3 years worth of crops. After the third year, farms are usually abandoned because of nutrient-depleted soils and the invasion of weedy

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species. Slash-and-burn agriculture produces about 80% of the human food supply in the Amazon as other, more intensive agriculture programs focus on crops for export (Serrão and Homma 1993).

It appears that no one, including the government, farmers, ranchers, or lending agencies, foresaw perhaps the largest impediment to Amazon development: soil degradation. Soils in tropical regions are millions of years old, having escaped major disturbances like glaciation that reset the clock on soil development (Richter and Markewitz 1995). Old soils are highly weathered aluminum and iron oxide clays that are acidic and deficient in plant nutrients, especially phosphorus. Tropical ecosystems are adapted to nutrient-poor soils as evidenced by the relatively large fraction of ecosystem nutrients stored in vegetation (compared to soils) and widespread plant adaptations like evergreen leaves that conserve nutrient loss (Vitousek and Sanford 1986). Many attempts to bring land under cultivation or conversion to pasture for cattle have failed in the long run without supplements from fertilizers and pesticides (Fig. 5). Cattle numbers decline from an average of two healthy head per hectare following clearing to less than 0.3 head per hectare 20 years following clearing (Serrão and Homma 1993). After just two years of grazing, some cattle exhibited 20% mortality and complete reproductive failure due to a lack of phosphorus in pasture grasses (Buschbacher 1987). Land reclamation efforts often require \$250 to \$475 per hectare for fertilizers and weed management, an enormous sum compared to a cost of \$70 to clear an additional hectare of virgin forest (Serrão and Homma 1993, Southgate 1998).

Even with a bounty of unclaimed natural forest, peasant farmers found it difficult to coexist with cattle ranchers in the Amazon. In addition to the problems of soil fertility, land grabbing followed the appropriation of the Amazon frontier, leading to many bloody clashes between cattle owners and peasant farmers. A recent estimate suggested that of the 4 million residents of the Amazon, 150,000 or 4%, are forcibly evicted from their land each year (Hall 1989). From the perspective of cattle ranching, it is cheaper to appropriate pasture by the forced removal of farmers than to clear forest. High-profile efforts to secure land rights for peasant farmers, including those by a group of rubber-tapping agriculturists, led to the assassination of their popular leader, Chico Mendes, in 1988. Amazon specialist Anthony Hall states, "It goes without saying that for farmers everywhere, access to land is the single most important factor in securing a livelihood." Forced eviction from their land meant that rural poor simply carved deeper into primary Amazon forest. Without government support to legitimize land rights, and with constant pressures from land grabbers, colonists greatly discounted the value of their land. Environmental consultant Douglas Southgate notes that "habitat will never be safe as long as the rural poor are neglected."

Eviction and land grabbing grew worse throughout the 1970s and '80s as land prices grew faster than Brazil's inflationary economy. Between 1966-1975 Amazon land values skyrocketed 100% per year (Hall 1989) because of high beef prices and newfound access to the Amazon via roads (Southgate 1998). Farmers and ranchers alike were clearing land and staking claims, many of which were heavily subsidized by the government. A careful evaluation of cattle productivity in 1978 indicated that SUDAM subsidies successfully led to land clearing but were not so successful in generating beef production. In fact, cleared forests supported only 36% of the cattle that were supposed to have been put to pasture (Hall 1989). Clearly, with soaring real estate value and subsidies, ranchers were driving land speculation and hoarding instead of cattle.

In addition to agriculture and cattle ranching, the Amazon offers an abundant supply of timber, which is cut for fuelwood and industrial uses (sawnwood, plywood, and veneer). Timber industries and some peasant farmers have employed a variety of forest extraction practices: selective cutting, non-timber extraction, and agroforestry. The particular practice used is determined by its opportunity cost, forest species composition, and the decision to extract resources from primary or secondary-growth forests. In addition, forestry options support different levels of employment: 300 people per veneer plant, 34 people per sawmill, and 13 people per logging firm (Serrão and Homma 1993, Southgate 1998). Hundreds of indigenous Amerindian populations have survived in the Amazon for thousands of years from the sustainable use of forest products (Grainger 1993).

Of the 300 or so tree species that may be found in a single hectare of rich Amazon rainforest, only 30 to 50 are commercially attractive (Grainger 1993). For the Amazon, species diversity is a mixed blessing, because Brazil supports the lowest commercial standing volume of any tropical country--a mere 5m³/hectare (Grainger 1993). This low volume of commercial timber makes clearcutting a nonviable option. The Amazon has been logged mainly by selective cutting of a few desirable commercial species, such as mahogany, teak, and *Gmelina*.

Selective cutting involves traveling across the landscape surveying and cutting valuable trees but implementing practically no forest management practices. Forest management techniques, such as cutting vines to prevent damage to adjacent trees, directional felling, and building low-impact skidder trails, may cost \$120 per hectare (Southgate 1998). As with slash-and-burn agriculture in a jungle with seemingly limitless resources, there is simply no

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incentive to conserve when it's cheaper to move on to the next tract of land. Consequently, for every tree cut, several trees are probably damaged or killed. One estimate puts this number as high as 27 damaged individuals per tree harvested (Southgate 1998). Moreover, logging increases forest vulnerability to future fire and further forest losses (Nepstad et al. 1999).

Another concern with the abundance of forests is that stumpage values (the cost of buying the rights to cut a tree) are very low. In the Amazon, stumpage ranges from \$5/m³ for less desirable species to over 70/m³ for mahogany (Southgate 1998). For most species, mills now pay \$35/m³ for cut timber (1998 dollars; Southgate 1998). Because of the costs of management and the low stumpage and value of land, sustainable production from primary forest appears futile. Consider that the total value of a regenerating mahogany stand may rise 5% per year, which is much less than current financial interest rates in Brazil (45% in 1999) (Southgate 1998). For slow-growing tropical species that may take over 100 years to establish and grow, the economic reality is alarmingly clear: It is more profitable to harvest a species to extinction and invest the profits in an interest-bearing bank account than to grow the species sustainably in a primary forest (Clarke 1973, Terborgh 1999). Southgate puts it succinctly, "Since timber resources are virtually boundless, market forces are stacked strongly against conservation."

Because of the dimming hope for sustainable timber extraction from primary tropical forests, other work has highlighted the potential value of extractable, non-timber resources as well as intensive agroforestry systems (Fig. 6). One study suggests that annual harvesting of non-timber products, such as Brazil nuts, rubber, varnish, and fruits, may provide an annual income of \$422 per hectare (Peters et al. 1989).

However, this value is probably a significant overestimate because it is based on a forest stand containing a high fraction of commercial species, and it does not account for declining prices as more goods are brought to markets (Southgate 1998). Intensive agroforestry programs that farm rapidly growing commercial trees or a mix of trees with crops, such as coffee, are gaining popularity (Grainger 1993, Southgate 1998). Grainger (1993) suggests that a commercial plantation of teak may produce 245m³ of timber per hectare over a 65-year period. *Gmelina* may produce 150m³ per hectare over a 10-year period. Assuming a tropical timber value of \$20-35/m³, this style of production may forestall the widespread destruction of forests while providing an income more attractive than land-clearing alternatives. Whether these yields can compete with the opportunity cost of one year of agriculture (\$460 per hectare), especially as increased forest production drives down timber prices, remains to be seen. In addition, peasant farmers without access to investment opportunities may have no alternative to slash and burn agriculture. It is clear that deforestation in the Amazon is driven by the relative costs and benefits of different land use options. How do value judgments implicit in these decisions reflect current political, social, and environmental conditions? Do these values reflect the true costs and benefits of the forests? How much do these values reflect individual interests and social welfare? This case study examines the valuing process involved in making the decision to clear a plot of primary forest in the Amazon Basin, from the perspective of a peasant farmer, a logger, and a conservation organization.

What is the environment really worth? Non-market values and intergenerational fairness

A growing number of ecologists and economists realize that economic valuation of tropical goods leaves out or "externalizes" too many costs, such as pollution that damages the environment, while failing to "capture" the whole value of environmental goods and services (Costanza et al. 1997a, Daily et al. 1997). Ecological economists argue that economic decisions need to incorporate, in addition to the market value of tropical forests, the non-market values that people have for the environment.

These include

- **Non-consumptive use values**: uses that are not "extracted" from the environment, such as birdwatching, sunbathing, paying for a documentary or TV show about the environment, photography, tree climbing, among others.
- **Existence values**: non-consumption "appreciation" or moral values, including the intrinsic value of species existence, stewardship, and the value of preserving the environment for future generations. This last category has received considerable attention, and the human welfare benefits provided by the environment are called *ecosystem services*. There are many functions that ecosystems perform that, if permanently damaged, would cost

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humans to replace. Table 1 presents global ecosystem services recently identified by a group of ecological economists.

Table 1. Ecosystem services and examples (modified from Costanza et al. 1997b).

Ecosystem service	Ecosystem functions	Examples
Gas regulation	Regulation of atmospheric chemical composition	CO ₂ /O ₂ balance, O ₃ for UV protection
Climate regulation	Regulation of global temperature, precipitation	Greenhouse gas regulation
Disturbance regulation	Damping of ecosystem response to environmental fluctuation	Storm protection, flood control, drought recovery
Water regulation	Regulation of hydrological flows	Providing water for agricultural industrial, and human uses
Water supply	Storage and retention of water	Provisioning of water by watersheds and aquifers
Erosion control & sediment retention	Retention of soil within an ecosystem	Prevention of soil loss from wind and runoff
Soil formation	Soil formation processes	Weathering of rock and the accumulation of organic matter
Nutrient cycling	Storage, internal cycling, processing of nutrients	Nitrogen fixation, N, P and other nutrient cycles
Waste treatment	Recovery of mobile nutrients and breakdown of excess nutrients	Waste treatment, pollution control, detoxification
Pollination	Movement of pollen	Insects and birds that pollinate crops
Biological control	Trophic-dynamic regulations of populations	Keystone predators, reduction of herbivory by top predators
Refugia	Habitat for resident and transient populations	Overwintering grounds for waterfowl
Food production	Portion of NPP extractable for food	Production of fish, game, crops, nuts, fruits
Raw materials	Portion of NPP used for raw materials	Production of lumber and fuel
Genetic resources	Sources of unique biological materials	Medicines, genes for the resistance of pathogens
Recreation	Providing opportunities for recreation	Ecotourism, sport fishing, other outdoor activities
Cultural	Providing opportunities for non-commercial uses	Aesthetic, artistic, educational, spiritual, and scientific value

Most of these ecological services we take for granted every day because they are free. Costanza and others try to "capture" non-consumptive values in order to make economic benefit-cost analyses reflect the true value of nature, or, equivalently, the true costs of polluting and degrading the environment. The more humans damage the global environment, and permanently alter or disable the free ecological services that nature provides, the greater amount

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of money we will have to spend to provide these services ourselves. Some services, like global gas regulation or ozone, may be impossible to replace.

How do we determine prices for these non-market values? Unfortunately, this is a very difficult task. Some argue that we cannot put a price tag on nature for at least three reasons (Sagoff 1997): (1) benefit-cost analysis is a flawed means of environmental protection, (2) we cannot accurately assess nature's existence value, just as we cannot put a price tag on human beings, and (3) nature's services are not subject to market forces that would reveal their economic worth. Costanza and colleagues reply that we implicitly value the environment in every-day decisions, and that we must value nature to expose the true costs of doing business (Costanza et al. 1997a). This idea is reiterated by businessman Paul Hawken: "While there may be no 'right' way to value a forest or a river, there is a wrong way, which is to give it no value at all" (quoted from Costanza et al. 1997a).

Two methods that ecological economists use frequently to estimate non-consumptive use values and existence values include: (1) people's willingness to pay for protecting the service and (2) the cost of travel to experience nature--at a national park, for example. Environmental economists recently conducted a survey of Americans to determine how much (in a one-time payment) they would be willing to pay to permanently protect 10% of the world's tropical forests (Kramer and Mercer 1997). They found that Americans are willing to pay about \$21 to \$31 per household, about \$3 billion total, or \$110 to \$230 per hectare of rainforest. Ecotourism can generate a significant income for tropical countries. In 1994, the amount of money from tourism in Costa Rica generated an equivalent of 28%, or \$623 million, of total exports (Southgate 1998). In ecologically unique areas, or areas that are perceived as safe for travelers, such as the Costa Rica and the Galapagos Islands of Ecuador, ecotourism may introduce between \$102 to \$1,273 in the local economy per foreign traveler. The total costs for travel and spending by foreign visitors to tropical destinations is often between \$1,400 to \$2,000 per person. However, in less unique areas, such as La Selva, Costa Rica, ecotourism generates only \$23 per person (Southgate 1998).

Another major concern with deforestation is the permanent loss of genetic information in tropical biodiversity. Perhaps as much as 40% of medicines worldwide contain chemicals derived from wild plants and animals (Durning 1993), suggesting that the tropics may harbor many additional plants with medical uses that are presently unknown. In 1991, Merck signed a historical agreement with Costa Rica to "bioprospect" plants to search for new compounds in exchange for a one-time payment of \$1 million. The potential value of the genetic resources in tropical forest for pharmaceutical discoveries has recently been valued at around \$21 per hectare (Simpson et al. 1996). In addition to medical uses, many of our crops like potatoes are of tropical origin. Mountain farmers in the Andes of Peru routinely grow several varieties of potato crops that could serve as important sources of genetic resistance to disease, such as the potato famine that struck Ireland in the 1840's.

Other environmental damage costs can be attributed to deforestation. Ecological economists have estimated that the damage caused by sea level rise from global warming is equivalent to \$20 per ton of carbon emitted in fossil fuels or from deforestation (Southgate 1998). Deforestation eliminates the capacity for vegetation to remove carbon dioxide and causes this greenhouse gas to rise in the atmosphere, which may lead to significant global warming (Mann et al. 1998). Given that an average of 100 to 200 tons of timber is cleared for slash-and-burn agriculture (Southgate 1998), the global environmental cost of clearing a hectare of tropical forest is \$1,000 to \$2,000, assuming a carbon content of 50% in plant biomass (Schlesinger 1997). In many cases, farmers are willing to accept \$5 to \$10 per ton of timber to prevent them from clearing the forest (Southgate 1998). In a novel international agreement, Norway has recently paid Costa Rica \$2 million to set aside forests for carbon sequestration. International willingness to pay is becoming a popular method for conserving tropical forests while compensating developing nations. Indeed, some tropical ecologists suggest that the only way to save the rainforest is for citizens in industrialized countries to pay for its protection (John Terborgh, personal communication). Unfortunately, however, for most of the ecological services presented in Table 1, there are currently very little data to value non-consumptive uses in the Amazon.

III. THE PROBLEM

At the frontier of primary Amazonian rainforest, a five-hectare plot is under consideration for deforestation by a local peasant farmer who wants to practice slash-and-burn agriculture and by a logger who wants to remove valuable timber species. Your group should examine the benefit of clearing or not clearing this land from one of three perspectives: (1) [the farmer](#), (2) [the logger](#), and (3) [an environmental conservation organization](#). You will generate a list of the values appropriate to your interest using the data sheets provided. Put yourself in the position of the group you represent, and be faithful to the economic and social pressures of each. Be creative! There are no right or wrong

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answers. There is no limit to the kinds or numbers of values you include. Financial data presented earlier are included in the [data appendix](#) for easy reference.

If relevant to your position, you may wish to determine non-consumptive values by conducting an informal willingness-to-pay survey within your group in addition to data presented in the appendix. Ask each member how much s/he is willing to pay to protect this 5-hectare forest. Be creative by using willingness-to-pay and travel cost methods to determine values for as many ecological services as you can.

IV. QUESTIONS FOR FURTHER THOUGHT

1. Based on this simplified form of benefit-cost analysis, which land use option wins?
2. Evaluate the ways that peasant farmers, loggers, and conservation organizations approach land use. Which do you agree with? Is there room for peaceful coexistence in the Amazon, especially with the prospect of population growth?
3. Support or criticize the use of benefit-cost analysis as a means of economic planning and as a means of preventing environmental degradation. Do you agree more with Costanza (1997b), Pearce (1998), or Sargoff (1997)? Do you feel that species have intrinsic rights to exist? Can such existence values be incorporated into environmental policy?
4. Do you believe that citizens of tropical countries have the right to deforest the most biologically diverse communities on earth? Compare and contrast the economic and environmental issues of tropical deforestation with deforestation that occurred in the US and Europe over the last several hundreds of years.
5. John Terborgh, tropical ecologist at Duke University, asserts that in order to save tropical forests, citizens of industrial nations are going to have to pay developing countries. Do you agree? What are some ways that this might be done?

V. GLOSSARY

Agroforestry: The production of commercial timber or a mix of crops and forest products.

Benefit-cost analysis: An economic method for weighing the pros and cons when valuing a product or service.

Biodiversity: The number of species in a given area.

Biomass: The amount of matter, usually expressed in grams, kilograms, or tons, stored in living organisms.

Bioprospecting: Exploring biodiversity resources for genetic, medicinal, food, or other human uses.

Consumptive use value: The actual price for a product as determined by the marketplace. For environmental products, it represents the price for products or services that are extracted from the environment (timber, water, fish, fruit, hunting licenses, camping fees).

Ecosystem: The interaction of organisms and their environment.

Ecotourism: Tourism industry where national and foreign citizens visit natural areas, such as a national park

Existence values: nonconsumptive "appreciation" or moral values, including the intrinsic value of species existence, stewardship, and the value of preserving the environment for future generations. This last category has received considerable attention, and the human welfare benefits provided by the environment are called **ecosystem services**. There are many functions that ecosystems perform that, if permanently

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damaged, would cost humans to replace. Fresh water, UV protection by ozone, and clean air are examples of ecological services.

Gmelina: A commercially valuable rainforest tree species.

Hectare: A unit of area equal to 10,000 m².

Mahogany: A commercially valuable rainforest tree species.

Nonconsumptive use values: uses that are not extracted from the environment, such as bird watching, sunbathing, paying for a documentary or TV show about the environment, photography, tree climbing, among others.

Slash and burn agriculture: Cutting a small patch of forest, usually 3-4 hectares, burning the vegetation, perhaps after selling a minor fraction of timber, and growing and harvesting 2-3 years worth of crops. After the third year, farms are usually abandoned because of nutrient-depleted soils and the invasion of weedy species.

Stumpage: The price of buying the rights to cut a tree on privately owned land.

Teak: A commercially valuable rainforest tree species.

Travel costs: The amount of money people spend to visit natural areas like national parks; a method that is used to determine nonconsumptive use and existence values.

Willingness to pay: The amount of money people would donate to protect the environment; a method that is used to determine nonconsumptive use and existence values.

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Study: Economic Boost of Deforestation Is Short-Lived

By [BRYAN WALSH](#) Friday, June 12, 2009



Hundreds of acres of former Amazon jungle destroyed by loggers and farmers lie next to virgin rain forest in Mato Grosso, one of the Brazilian states with the greatest deforestation

Rickey Rogers / Reuters / Corbis

For the people who live in the Brazilian rain forest, the perfectly logical thing to do is cut it down. Large swaths of the rain forest are burned or chopped down each year (4,621 square miles in 2008) because that land is worth more to its human denizens deforested — for the value of the timber and the cleared farmland — than it is intact.

The ecological fallout is, of course, immense. The Amazonian rain forest is perhaps the

most densely populated place on Earth — inhabited by a vast variety of plants and animals that we have not yet begun to map — and it is also the largest terrestrial carbon sink on the planet, absorbing 2 billion metric tons of carbon dioxide in a normal year. **(See the top 10 green stories of 2008.)**

The argument for deforestation has always been that the economic benefits to local communities are too great to overlook. But now a new study in the current issue of *Science* suggests that's not true. A team of researchers from Portugal, France and Britain studied nearly 300 Brazilian municipalities on the frontier of the Amazonian rain forest, assessing their development levels — based on income, life expectancy and literacy rates — before deforestation and afterward. Researchers found that logging forests and converting the land to pasture and agriculture initially raised development levels in a burst of prosperity. But in the years that followed deforestation, that bubble of prosperity popped, and development levels declined until on average the communities were no better off than they had been before the trees were destroyed. **(Read "The Amazon Gets Less and Less Green.")**

The result is a boom-and-bust pattern that destroys irreplaceable forest but does little to improve long-term prosperity. "It really is a lose-lose situation," says Robert Ewers, a biologist at Imperial College London and a co-author of the study. "The forest is gone so you lose the conservation value of the forest, and eventually you lose the additional income as well." It's not hard to see why deforestation pays off, at least initially. As trees are cleared, they can be sold for timber — and the buzz of activity surrounding deforestation attracts migrants who capitalize on newly available land, timber and minerals. As the human population increases, so does the demand for roads and other transportation that can connect once isolated communities

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with valuable markets, and vice versa. That also leads to better access to education and health care, which helps boost literacy rates and life-expectancy levels. Eventually, development levels in newly deforested communities can match and even exceed the Brazilian average.

But those improvements are transitory. The denser population quickly uses up the new natural resources, as timber is sold, and the Amazonian soil, never rich to begin with, is rapidly exhausted. (The researchers note that by the early 1990s, more than 75% of the land that had been deforested up to then had been converted to pasture — and that one-third of that territory had already been abandoned.) Per-capita income, life expectancy and literacy rates all drop, as jobs disappear and the better-educated, better-off migrants move onto the next frontier. "In net terms," the authors write, "people in municipalities that have cleared their forests are not better off than those in municipalities who have not." **(See a graphic of the effects of climate change on the world by 2020.)**

That's the problem, though. While deforestation apparently offers few long-term benefits, Brazilians in forested communities aren't very well off either — at least by Western standards — as there is still little to stop them cutting down trees, even if it's only for short-term gain.

Deforestation is still unlikely to stop, at least for economic reasons. "For a win-win situation, you need to install some value for standing trees," says Ewers.

The rain forest may be an irreplaceable part of Earth's ecology, but there's no way to sell that on the market yet. However, there is a nascent movement to put a dollar value on the billions of tons of carbon sequestered within the rain forest: in avoided deforestation, forest communities like those in Brazil could essentially be paid for not cutting down their trees, by trading on the carbon value of their forest in a global greenhouse-gas market. With tropical deforestation responsible for up to one-third of global carbon emissions, there's a powerful climate reason to find a way to economically end rainforest destruction.

Currently forests aren't included in the Kyoto Protocol, but there is a lot of optimism that avoided deforestation will be a part of whatever global deal is negotiated at the U.N. climate summit in Copenhagen at the end of the year. (Diplomats are meeting this week in Bonn to work out some of the early details.) The *Science* study provides one more piece of evidence that forests — especially for those who depend on them — are ultimately worth more alive than dead.

Read more: <http://www.time.com/time/health/article/0,8599,1904174,00.html#ixzz1zWh1oy3a>

Poverty and Deforestation



**Generalizations
about
poverty and
deforestation
make a poor
foundation
for policy**

Picture Credit: Frans Lanting, Corbis. Legend: Rural residents depend on forests and woodland for fuel and other resources. Women carry firewood in the spiny forest region of Madagascar

About 800 million people--many of whom are extremely poor--live in or around tropical forests and woodlands, depending on them heavily for much of their food, fuel, and income.

Tropical forests are shrivelling before our eyes

Satellites allow us to watch forests burn in real time. Tropical forests are shrinking at about 5 percent a decade. This may not sound like very much, but it implies annual forest loss of an area the size of Portugal.

Pressures on forests will not disappear soon. Croplands, pastures and plantations are expanding into natural forests and will likely do so for the next 30 to 50 years.

A huge rural population relies on low-productivity agriculture for subsistence. A growing, increasingly wealthy urban population demands commodities produced at the forest's edge: beef, palm oil, coffee, soybeans, and chocolate.

Generalizations about poverty and deforestation make a poor foundation for policy

The relationship between poverty and deforestation eludes simple generalizations.

Assumptions such as 'poverty causes deforestation' and 'deforestation causes poverty' are a poor foundation for policy.

Poor subsistence farmers do cut down trees, but so do rich ranchers and plantation owners. Deforestation is in fact undertaken by both rich and poor people, for high and low gains.

In Madagascar, poor people clear forests for tiny, unsustainable, short-term gains--as little as \$39 a hectare a year, for only a few years. In Indonesia or Cameroon, households can create cocoa farms worth \$1500 or more.

In the Brazilian Amazon, about 80 percent of deforestation occurs in clear-cuts of 20 hectares or larger, reflecting commercial-scale activities rather than that of households.

Forests can be both a geographic poverty trap as well as a route out of poverty.

While deforestation often creates assets for poor people, it can also deprive them of assets. Indonesia, for instance, experiences disputes between plantation interests and local people over control of forest land.

Causes of forest poverty

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Poverty in forests stems from remoteness and a lack of rights.

The best, most accessible farming lands have long been cleared and tilled in many parts of the world. Forests and their inhabitants tend to be relegated to remote or unfavorable areas. As a result, places with high forest cover often have low population densities but high poverty rates.

Forest dwellers are often unable to tap forest resources. Sometimes this happens when governments or wealthy interests claim forests and restrict access. In other cases, forests effectively belong to no one—with the result that their resources are degraded through overuse.

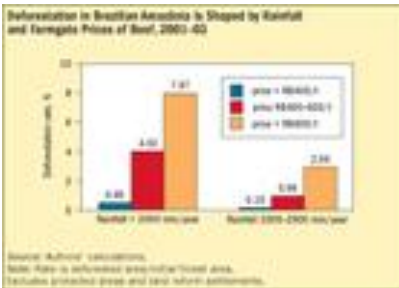
In Asia, tens of millions of people live in 'forests without trees'—state forest lands where trees have been removed but where zoning regulations make land tenure problematic.

Drivers of deforestation

Local conditions, incentives and constraints determine where and why deforestation occurs, and with what impacts.

Low wages, good soils, favorable climate, and higher prices for agricultural goods all motivate deforestation. This suggests that road improvements or agricultural policies that boost farm profitability will tend to accelerate deforestation.

Often, people find agriculture a more profitable and attractive land use than sustainable management of forests for timber and other products.



This figure shows how deforestation in Brazilian Amazonia is shaped by rainfall and farmgate prices of beef.

Source: Authors' calculations

Note: Rate is deforested area/initial forest area

Excludes protected areas and land reform settlements

Click [here](#) for a larger image

Where governance is weak and tenure poorly defined, powerful interests can seize forest resources and small-holders can engage in conflict-ridden races for property rights. But even landholders with secure tenure may choose deforestation if it offers higher returns.

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Deforestation in the Amazon

Student Ambassador: Emma Walsh-Alker



OWEd Ambassador Since: 2011

Grade: 7

School: Alice Deal Middle School



We rode a small boat on that scorching day with an even smaller motor. The cool water sprayed my face as we passed scenery like I had never seen before. The forest played with my senses as our boat's passengers marveled at the exotic life surrounding us. We passed villages, birds and trees that seemed straight out of the National Geographic picture show. While I've always cared about the environment, it wasn't until my trip last summer to the Amazon Forest that I understood why.

How could a place with so much beauty be in such danger of destruction and deforestation? Despite its beauty, the Amazon rainforest is being destroyed. Learning about the world's largest rain forest and how its resources are so crucial to medicine and nature and how quickly it is being deforested was appalling. The Amazon Rain Forest is at risk because of the removal of trees for resources such as wood, rubber and space so cattle can graze and then be slaughtered for beef, among many other reasons.

The Amazon Rainforest is also home to the largest variety of species in the world, from insects to dolphins to birds. In the next 25 years, if deforestation continues at this rate, nearly half the world's species of plants and animals will be destroyed or severely threatened. Deforestation doesn't just wreak havoc for trees and humans. It also means that monkeys, anacondas, exotic fish, bats, manatees and the thousands of other endangered species that make the Amazon what it is – or used to be – will be gone. Imagine someone tearing down your house and throwing out all your possessions just so they could have more room for their cattle to graze.



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According to the Rainforest Action Network, if deforestation continues at this rate the rainforest will be entirely lost by 2060. Research has shown that between the years 2000 and 2006, the Brazilian Amazon lost almost 93,206 square miles of rainforest due to deforestation. That is 93,206 out of about 3,179,715 square miles, an area almost as large as the United States.

Loss of the Amazon Rainforest also means loss of native peoples who have lived in the Amazon for thousands of years. Native tribal lands, resources, and culture are being wiped out due to deforestation. Approximately 500 years ago there were an estimated ten million indigenous people living in the Amazonian Rainforest. Today there are estimated to be less than 200,000. The pictures shown of the bare and dead Amazon – a place that once used to bloom with life – are devastating. But the situation becomes even more personal when you are there, seeing how much the people depend on the forest. Tribal rituals that rely on the land make up their oldest and most sacred ways of life. Native tribes are very poor and many have never strayed from their local language and traditions and they have little chance to stand up against the government and companies who are destroying their homes. Onlookers like us have to take a stand for them. Cutting down trees means more than damaging a forest; it means damaging lives. The Amazonian ecosystem existed in perfect harmony until humans, hungry for more resources, decided to disturb it. However, companies such as Wal-Mart, Toyota, and IKEA – according to Greenpeace – disregard these facts. Millions of people's furniture and cars are results of deforestation, making it an even bigger issue.

Why is the loss of the rainforest important? There are a million reasons and if the forest was protected, everyone would benefit. First, the Amazon Rainforest provides more than 20% of the world's oxygen. Second, there's a good chance that the food in your diet may have originated there, such as corn, potatoes, rice, nuts, chocolate, and coffee. Third, many plants in the jungle contain chemicals that doctors need to fight diseases such as cancer. And as I say from personal experience, the beauty of the rainforest is not fit for words. By cutting down the Amazon, humans are also hurting themselves by hacking up what I've heard some call the world's "last frontier."

If you can think about every piece of furniture or structure that is made out of wood, there's a good chance that wood can from a tree in the Amazon Rainforest. Scientists at Raintree Nutrition Inc. have calculated that the rainforest is worth about \$400 per acre in timber. Ironically, scientists have stated that the same amount of acreage could harvest enough resources to produce \$2,400 worth of medicines, without cutting down any trees. Scientists simply cannot explore what is being destroyed. To me, this proves that deforestation in the Amazon has many more cons than pros.



The earth's resources are not unlimited, and a great number of these resources come from the Amazon Rainforest. Maybe if we preserve these resources we will not have to wipe out South America to find more. For example, it's important to recycle as much as possible, not waste water, turn down the heat or air conditioning, and start a compost pile. You can even join a conservation group and educate your friends about this issue because the actions and decisions of this generation may be the Amazon's only shot at survival.

Thinking about the Amazon being destroyed leads me back to thinking about how lucky we are to enjoy comfortable living conditions and experience natural wonders, yet global warming is in the headlines every day. Preserving the Amazon is just one of many steps we could take to restore the earth, but it is one that must be taken. Scientists can tell you the facts, native peoples can tell you the reasons, and nature can display the results. Instead of harvesting power by destroying plants, animals, and indigenous tribes in the Amazon Rainforest, we should be working together with them to get the most out of Earth's resources. If we do not, my story about canoeing down the great Amazon River may be as close as you'll get to the incredible beauty that once stood before it was destroyed.

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Deforestation

Topic

Rainforest Destruction



What Causes It

For a while, we actually saw a slow down in rainforest destruction for timber and farming as people became aware of the great diversity of life in this habitat. But now, **Rainforests are disappearing at record rates again.** This is because in places like the Amazon in Brazil, people have begun *slashing and burning* the rainforest to use the land for cattle ranching. With more than 200 million cattle to feed, workers harvest a lot of the remaining rainforest every year. Brazil exports more beef than any other country in the world and they export it to fast food restaurants in the United States and Europe!

How Does It Affect Us

Rainforests are very productive habitats. They are home to a huge diversity of animals and plants, while supplying oxygen to our atmosphere and using up carbon dioxide. They hold moisture like a giant sponge and protect the ground from erosion. This keeps the soil from getting washed into rivers and plugging them up with sedimentation. All of these things would affect the lives of the people and animals in and around the rainforest.

What Has Been Done to Fix It

In 1994, at the **Earth Summit** (United Nations Conference on the Environment and Development) in Rio de Janeiro, Brazil countries from all over the world agreed to try to protect at least 12% of their wild habitats.

What Can You Do to Help

Americans kids eat a lot of fast food, even though it's expensive and full of fat and calories. Since a lot of beef comes from Brazil cattle ranchers, maybe next time you want fast food, have a soy burger instead!

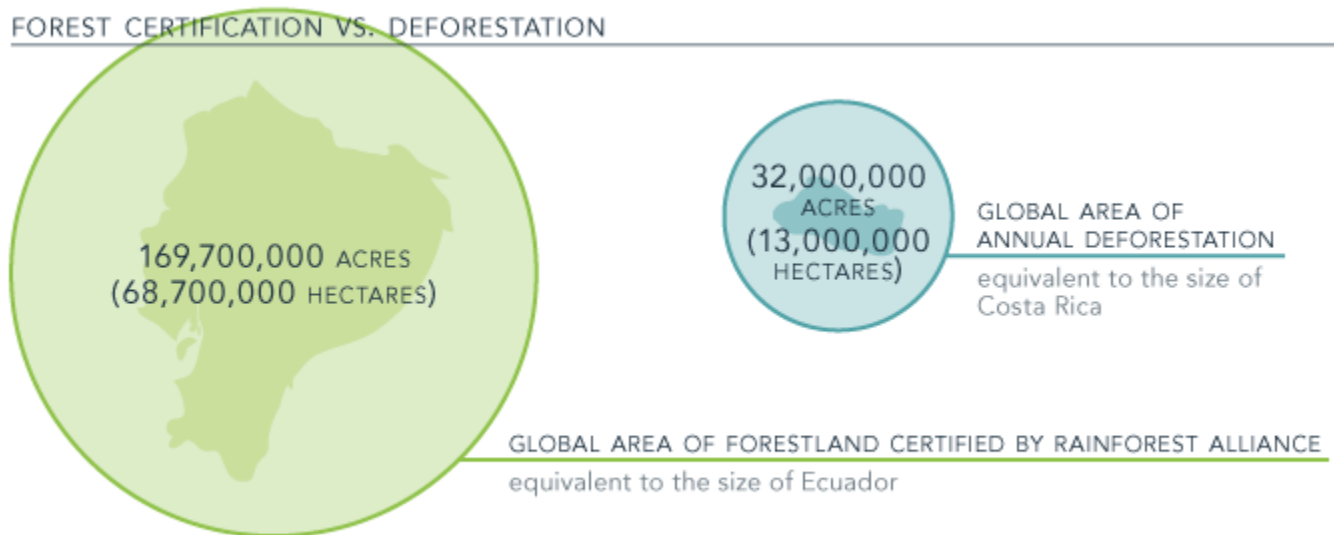
Instead of buying a cut Christmas tree, try having a live tree this year. This summer buy a balsam fir or blue spruce tree from a nursery and keep it in a large pot through the fall. You'll have to bring it inside before it gets too cold and water it, since it won't get rain. It

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FOREST CERTIFICATION VS. DEFORESTATION



SOURCE: FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

might be smaller than the trees you are used to having at Christmas, but it will be a live tree of your very own and next year, it will be bigger! You can also plant it in your yard and watch it grow.

Recommended Books and Products

For more information about **Deforestation** with Activities for K-8: ***The Everything Kids Environment Book, Adams Media 2007***

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Keeping Forests Standing

Illegal logging. Over-harvesting. Agricultural conversion. Forests are disappearing before our eyes. The result? Wildlife habitat is destroyed, species are going extinct at unprecedented rates, soils are eroded, water safety is compromised and climate change is exacerbated.

What We're Doing

For more than two decades, the Rainforest Alliance has worked around the world to stop deforestation by developing innovative and sustainable alternatives to forest destruction. While we recognize the need for forest products, like lumber and paper, we also know there are ways to produce these materials sustainably, without clear-cutting forests. Similarly, while farmers need to produce food, they don't need to eradicate the vegetation that protects streams, prevents soil erosion and provides habitat for wildlife.

The Rainforest Alliance solution? Through certification and verification, we provide forest managers, farmers and tourism entrepreneurs with the tools to manage their land responsibly -- preventing deforestation and forest degradation, increasing forest cover and conservation areas, and helping them generate the goods and services upon which we all rely. We are also working to help communities in biodiverse locations establish sustainable tourism businesses -- both attracting conservation-conscious travelers and providing communities with a sustainable alternative to potentially damaging activities, such as illegal logging and oil extraction.

Our Impact

- We've certified over 169 million acres (68.7 million hectares) of forestland around the world according to FSC standards, proving that responsible forestry is a viable alternative to deforestation. In many cases, FSC-certification protects forests better than even governments can; in the Maya Biosphere Reserve, for example, the rate of deforestation in government protected areas is 20 times the rate of deforestation in certified forest communities.
- Along with our partners in the Sustainable Agriculture Network (SAN), we've helped over 80,000 farms adopt practices that prevent deforestation, encourage reforestation and promote responsible land management. Together, we've developed standards for the certification of sustainable cattle farming and the production of biofuel crops, whose irresponsible cultivation has been a significant driver of rainforest destruction.

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- We've provided training to more than 2,000 tourism entrepreneurs, encouraging the operation of sustainable tourism businesses that are an economic boon to communities while encouraging the protection of forests and their inhabitants.

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Pre-industrial Deforestation Still Warming Atmosphere

[Jeremy Hance](#)

mongabay.com

July 03, 2012



Terraced rice paddies in Yunnan. Many of China's current agricultural areas were made by clearing forests and other natural vegetation hundreds to thousands of years ago. Photo by: Rhett A. Butler.

Fossil fuels were not burned in massive quantities prior to the Industrial Revolution, but humans were still pumping carbon into the atmosphere due to land use change, especially deforestation. In fact, a new study in *Environmental Research Letters* finds that deforestation prior to 1850 is still heating up our atmosphere today.

"The relatively small amounts of carbon dioxide emitted many centuries ago continue to affect atmospheric carbon dioxide concentrations and our climate today, though only to a relatively small extent," says co-author Julia Pongratz with the Max Planck Institute for Meteorology in a press release.

When a forest or other natural vegetation is cleared by burning, carbon dioxide is immediately emitted into the atmosphere. However, decaying vegetation, such as stumps and roots, will seep their carbon into the

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atmosphere over much long periods of time, sometimes centuries. In addition, carbon has the capacity to stay in the atmosphere for several centuries before being absorbed by the ocean or forests. This means, a portion of carbon from forests that were felled in the 19th Century and before still lingers in our atmosphere today.

Calculating the carbon emitted prior to the Industrial Revolution also provides new insights into climate change today, according to the authors.

Using complex modeling, they found that if one includes land use changes prior to the Industrial Revolution into carbon accounts, it would slightly boost the role of Asia in warming the world. South Asia, which includes India, would then be responsible 7 percent of total global warming, as opposed to 5.1 percent. While China's responsibility would rise from 8.2 percent to 8.7. Populations grew fastest in these region between 800 and 1850 AD, leading to widespread deforestation for agriculture to feed booming populations.

In all, the study's findings would shift the responsibility for current climate change from industrialized nations to developing countries by 2-3 percent. However, the authors emphasize that they are not intending to blame nations for deforestation that occurred hundreds of years by ancestors entirely unaware of the climatic impacts.

"Accounting systems are not natural facts, but human inventions," Ken Caldeira with Carnegie Institution for Science explains. "Once an accounting system is defined, it becomes a matter of scientific investigation to determine what numbers should go in the ledger, but broader questions of who is responsible for what and who owes what to whom are judgments that lie outside the scope of science."

Even with this accounting change, the biggest players in global warming would remain the same: North America, Europe, and the nations of the former Soviet Union are responsible for more than half of the world's current warming. This, despite the fact that India, alone, has a larger population than all of these combined.

According to Pongratz studies such as these provide an inherent warning for society today.

"Looking into the past illustrates that the relatively large amount of carbon dioxide that we are emitting today will continue to have relatively large

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impacts on the atmosphere and climate for many centuries into the future," she explains.

CITATION: Julia Pongratz and Ken Caldeira. Attribution of atmospheric CO₂ and temperature increases to regions: importance of preindustrial land use change. Environmental Research Letters. 2012. 7 034001.
doi:10.1088/1748-9326/7/3/034001.

Read more:<http://news.mongabay.com/2012/0703-hance-preindustrial-deforestation-carbon.html#ixzz1zibnv6MG>

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Threats to Madagascar's Biodiversity and Ecosystems

Madagascar is among the world's poorest countries. As such, people's day-to-day survival is dependent upon natural resource use. Most Malagasy never have an option to become doctors, sports stars, factory workers, or secretaries; they must live off the land that surrounds them, making use of whatever resources they can find. Their poverty costs the country and the world through the loss of the island's endemic biodiversity.

Madagascar's major environmental problems include:

1. [Deforestation and habitat destruction.](#)
2. [Agricultural fires.](#)
3. [Erosion and soil degradation.](#)
4. [Overexploitation of living resources](#) including hunting and over-collection of species from the wild.
5. [Introduction of alien species.](#)

DEFORESTATION

Deforestation in Madagascar is largely the result of three activities:

Tavy or slash-and-burn agriculture

Tavy is the lifeblood of Malagasy culture and the Malagasy economy. *Tavy* is mostly used for [converting tropical rainforests](#) in Madagascar into rice fields. Typically, an acre or two of forest is cut, burned, and then planted with rice. After a year or two of production the field is left fallow for four to six years before the process is repeated. After two or three such cycles, the soil is exhausted of nutrients and the land is likely colonized by scrub vegetation or alien grasses. On slopes, the new vegetation is often insufficient to anchor soils, making erosion and landslides a problem.



Tavy is the most expedient way for many Malagasy to provide for their families, and where day-to-day subsistence is a question there is little concern for the long-term consequences of the actions. From this perspective, as long as there is more forest land freely available for clearing, you might as well use the land before a neighbor does. *Tavy* for rice also has spiritual and cultural ties that transcend the economic and nutritional value of rice as a crop.

Logging for timber

Logging for timber is especially a problem in the rainforests of eastern Madagascar, particularly on the Masoala peninsula. The high value for Malagasy hardwoods (mostly ebony and rosewood, which may fetch \$2,000 a ton in international markets) makes illegal logging a significant problem in some protected areas.

Fuelwood and charcoal production

The endemic spiny forests of Madagascar are being cut at an alarming rate for charcoal production. In eking out a living selling little piles of charcoal along roads in southwestern Madagascar, local people turn towards the nearest plant source, which in this case is often *Alluaudia* trees.

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AGRICULTURAL FIRES

Every year as much as a third of Madagascar burns. Fires set for land-clearing and pastureland spread into adjacent wildlands, causing damage to the island's unique ecosystems.



EROSION

With its rivers running [blood red](#) and staining the surrounding Indian Ocean, astronauts have remarked that it looks like Madagascar is bleeding to death. This insightful observation highlights one of Madagascar's greatest environmental problems—soil erosion. Deforestation of Madagascar's central highlands, plus weathering from natural geologic and soil conditions, has resulted in widespread soil erosion, which in some areas may top 400 tons/ha per year. For Madagascar, a country that relies on agricultural production for the foundation of its economy, the loss of this soil is especially costly. [more](#) >>



OVEREXPLOITATION OF LIVING RESOURCES

Madagascar's native species have been aggressively hunted and collected by people desperately seeking to provide for their families. While it has been illegal to kill or keep lemurs as pets since 1964, lemurs are hunted today in areas where they are not protected by local taboos (*fady*). Tenrecs and carnivores are also widely hunted as a source of protein.

Reptiles and amphibians are enthusiastically collected for the international pet trade. Chameleons, geckos, snakes, and tortoises are the most targeted.

The waters around Madagascar serve as a rich fishery and are an important source of income for villagers. Unfortunately, fishing is poorly regulated. Foreign fishing boats encroach on artisanal fishing areas to the detriment of locals and the marine fauna. Sharks, sea cucumbers, and lobster may be harvested at increasingly unsustainable rates.

INTRODUCTION OF ALIEN SPECIES

The introduction of alien species has doomed many of Madagascar's endemic species. The best example of damage wrought by introduced species can be found in the island's rivers and lakes. Adaptable and aggressive tilapia, introduced as a food fish, have displaced the native cichlids.

There is really little use bemoaning past environmental degradation in Madagascar. Now the concern should be how to slow this ecological decline and how to best utilize lands already degraded so they support productive activities today and for future generations. Without improving the well-being of the average Malagasy, we cannot expect Madagascar's wildlands to persist as fully functional systems and continue to cater to the needs of their people.

Making conservation work in Madagascar

Designating an area as a park does not mean local people will have their immediate needs satisfied. A park does not alleviate their hunger or satiate their requirements for shelter and other necessities. Conservation in Madagascar must address the needs of local people, and efforts must focus on poverty alleviation and economic development as well as protecting wildlife and ecosystems. Conservation

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cannot come at the expense of local people; local people must be made both partners and beneficiaries in conservation, and not enemies of it. In seeking a "solution" to the environmental problems of Madagascar—whether it be through agroforestry, extractive reserves, ecotourism, or another strategy—the ultimate fate of its ecosystems rests in the hands of local people. While some would argue these wildlands can be "saved" by restricting economic growth, it is necessary to realize parks and reserves will not persist, let alone be successful, unless local communities are persuaded that it is in their material interest to conserve.

[Masoala—The Eye of the Forest: A New Strategy for Rainforest Conservation in Madagascar](#), a book on conservation in the biologically rich rainforest of the Masoala Peninsula, reiterates these points:

"Everyone who lives on the Masoala peninsula lives directly from the use of natural resources. Almost no one at Masoala has the option, let alone the means, to become a lawyer, doctor, journalist, pilot, bus-driver, secretary, mechanic, or librarian, let alone to aspire to a leisurely retirement. Average life expectancy in Madagascar is about 56 years. Everyone's survival strategy is therefore centered in one way or another around natural-resource use. In such a context, if villagers find themselves with a little extra money in their pockets, the best investment they can possibly make is to plow the money back into clearing more land for rice or cash-crop production. As a result, while economic development and poverty alleviation are vital to help rural communities out of their dependence on survival strategies based exclusively on natural-resource use, programs that aim simply to increase incomes often end up accelerating environmental degradation. Poverty reduction programs at site like Masoala therefore need to be planned and implemented in coordination with natural-resources managers to make sure that environmental factors are taken into consideration and that economic development is ecologically sustainable."

Success in conserving wildlands in Madagascar will require reconciling the inevitable conflicts between short-term needs of local people and the long-term nature of the benefits that conservation can generate on a sustainable ongoing basis. The following sections will look at specific ideas that may address some of the underlying and direct causes of environmental degradation in Madagascar.

AGRICULTURE

[Subsistence agriculture](#) is a way of life in Madagascar. Tavy may have evolved as the most efficient agricultural strategy for given environments in Madagascar but as currently practiced—with fallow periods too brief to allow sufficient regrowth of vegetation—it is not a viable cultivation technique. A better approach to addressing the needs of poor Malagasy farmers may be improving and intensifying currently existing agricultural projects and promoting alternative cultivation techniques—notably permaculture as "savoka" gardens.

Savoka gardens are planted on fallow tavy plots and are planned as "a carefully selected succession of trees and plants on the fallow land that re-enriches the soil at the same time as producing a steady stream of food crops and other useful products." For example, the use of wild ginger (*longoza*) adds phosphorus to soils while leguminous plants can fix nitrogen that is lost with traditional rice cultivation. The addition of perennials—crops which continue to produce for a number of years like citrus, manioc, vanilla, banana, mango, pepper, cacao, coffee, and rubber—can help restore nutrients to degraded soils and remain productive for decades while generating a diversified income and/or diet. A bonus of such agroforestry techniques is that they maintain forest systems, soils, and biological diversity at a far higher level than do conventional agricultural techniques. As long as such fields are adjacent to secondary and old-growth forest, many species will continue to thrive.

Unfortunately, success with such regimes has proved elusive thus far. Tavy and the devotion to rice is so established as a cultural practice that it has been very difficult to interest the Malagasy in alternative crops that might improve soil fertility and increase crop yields. Successful implementation of savoka gardens will probably hinge on integrating rice cultivation with these new techniques, in addition to improving access to markets and creating credit facilities for poor farmers in order both to save their earnings and allow

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them to borrow in times of need. Micro-credit facilities can provide significant economic benefits to local people and the local economy.

OTHER SUSTAINABLE FOREST PRODUCTS

Improved forms of agriculture are among several means that can provide tangible returns to rural Malagasy living in and around forests. Sustainable development through harvesting of the forests' renewable products has the potential for generating income for local people without destroying their resource base.

According to [Masoala—The Eye of the Forest A New Strategy for Rainforest Conservation in Madagascar](#), more than 290 plant species on the Masoala peninsula alone "are used by local people: as fuel wood, as wood for construction, for medicinal purposes, carving, and other purposes." Such forest products have a great deal of potential in both local and international markets. For example, two chemicals, vincristine and vinblastine, derived from the rosy periwinkle of southern Madagascar, generated more than US\$160 million per year in their heyday . Rainforest plants have already provided tangible evidence of their potential to address all sorts of medical problems, from childhood leukemia to hangovers. Seventy percent of the plants identified by the U.S. National Cancer Institute as having anti-cancer characteristics are found only in the tropical rainforest. Rainforest plants have been estimated to be responsible for 25 percent of the drugs used by Western medicine.

Vanilla has long been a lucrative, but eco-friendly crop for many farmers in northeastern Madagascar since it grows best under the shade of canopy trees. But, according to [Masoala—The Eye of the Forest A New Strategy for Rainforest Conservation in Madagascar](#), "a new variety [of vanilla] introduced recently as part of an EU-funded economic support program is sun-tolerant" and therefore better suited as a plantation crop. This new form may drive small producers out of business and contribute further to deforestation.

The key to making sustainable forests products an economic reality for local Malagasy is access to markets.

ECOTOURISM

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Ecotourism may be the best hope for Madagascar to improve the standard of living for its people and indeed ecotourism is growing in the country: according to the [Bradt guide](#) around 50 percent of visitors to Madagascar now visit a protected area when they come to the country (up from 20 percent in 1995). Responsibly managed [ecotourism](#) can generate substantial amounts of revenue and employ large numbers of local people without causing significant environmental damage. And because ecotourists pay to see a country's natural beauty it gives local people a direct incentive to conserve the environment around them. Ecotourism can help assign value to an ecosystem, and most ecotourists are willing to pay directly for preservation in the form of park entrance fees and the hiring of local guides.

In Madagascar local communities benefit directly from ecotourism through their 50 percent share of park entrance fees (park entry fees are divided equally between [ANGAP](#) and local communities), sales of handicrafts and "tourist items," and employment as porters, wildlife guides, park rangers, and workers in the service force of hotels, restaurants, and lodges. The guide-training programs ([ANGAP](#) has a three-year program for new guides) help the local community as a whole through the education of its members. With an education and an understanding of multiple languages, children in the community will have better opportunities in the future.



Zaka, an ecotourist guide in Andasibe

To be sustainable, ecotourism requires careful planning and strict guidelines; short-term development can doom ecosystems and communities just as unsustainable logging does. Too many people, inadequate facilities, and poor park management can spell the end for the "eco" in ecotourism. Ecotourism, when carried out in a sustainable fashion, can benefit local people, the economy, and the environment. Ecotourism should not be restricted to legally protected areas, but also be promoted in natural areas that lack protection. The presence of tourists, when properly managed, can protect an area from certain over-exploitive activities.

INCREASING PRODUCTIVITY AND REHABILITATING DEGRADED HABITATS



Gray Mouse-lemur recently born in captivity at the Bronx Zoo in New York. Zoos will play an increasingly important role in the future

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In addressing environmental problems in Madagascar, it is important that decision makers not only be concerned with the transformation of existing natural ecosystems, but also the more rational utilization of already cleared and degraded areas (for example the use of "savoka" gardens). To lessen future forest loss, we must increase and sustain the productivity of farms, pastures, plantations, and scrub land in addition to restoring species and ecosystems to degraded habitats. By reducing wasteful land-use practices, consolidating gains on existing cleared lands, and improving already developed lands, we can diminish the need to clear additional forest.

of conservation by providing a refuge of last hope for species that have lost crucial habitats. Zoos can also help reintroduce endangered species into the wild.

Research and experience have shown that the restoration of entire ecosystems is most possible in regions where parts or at least remnants of the original forest still remain and there are few human population pressures. Small clearings surrounded by forest recover quickly and large sections may recover in time, especially if some assistance in the reforestation process is provided. After several years, a once barren field can once again support vegetation in the form of pioneer species and secondary growth. Although the secondary forest will be low in diversity and poorly developed, the forest cover will be adequate for some species to return (assuming they still exist). In addition, the newly forested patch can be used for the sustainable harvest of forest products and low-intensity logging and agriculture.

ENFORCEMENT

Laws protecting the environment in Madagascar have been on the books since the 19th century but have had little effect. Effective conservation efforts will require the consistent enforcement of existing laws.

Corruption has long been associated with the violation of environmental statutes in Madagascar: pay a bribe to the right official and certain prohibited activities will be overlooked. This has all changed in the last couple of years with the push by president Ravalomanana to clean up business affairs and the legitimizing of SAPM (ANGAP) (Madagascar's national parks service) by giving it the power to enforce the law.