

State of the Environment: Belize

By

Rex E. Medlin Jr.

Department of Biological Sciences, Arkansas State University, State University 72467

Phone: (870) 972 3082, Email: rex.medlin@smail.astate.edu

Date Submitted: 25 March 2008

Abstract

Belize is a small country of rich cultural and ecological diversity located on the Eastern shore of the Yucatan peninsula in Central America. The country is a case study in ecological alteration, as the area has faced environmental challenges since early Maya settlement. Today, Belize is balancing economic development and population rise with deforestation, waste disposal, and the effects of ecological tourism. While there is little evidence of environmental degradation caused by either nuclear waste or automobile exhaust, Belize does face the challenges of providing clean drinking water to its citizens and enforcement of environmental legislation.

Introduction

Belize is a small country in Central America on the Western edge of Caribbean Sea. It is located on the southeastern portion of the Yucatan peninsula, and is bordered by Mexico to the North and Guatemala to the West and South (Figure 1). Belize is renowned for possessing the second largest barrier reef in the world, as well as for having a rich ecological and cultural diversity (Young 2007a). Like many Central American countries, Belize is challenged with preserving the integrity of its natural heritage while simultaneously developing institutionally and economically. Significant specific challenges include solid waste disposal, water quality, and deforestation.

Culture and Demographics

Formally British Honduras, Belize gained its independence from Britain in 1981 (World Factbook 2007). As a result of its British occupation, it is the only mainland Central

American country whose official language is English (World Factbook 2007). However, over 69% of the population speaks Spanish as well (Young 2007b). Belize has a rich ethnic diversity (Table 1), with some eight ethnic groups who speak a variety of native languages (World Factbook 2007). The largest ethnic group is Mestizo, which is of Hispanic and American Indian ancestry and comprises about 49% of the population (World Factbook 2007).

Modern Belize encompasses 22,966 km² and has a population of 294,385 (World Factbook 2007). Thus, Belize has one of the lowest population densities in Central America (FAO 2004). The annual growth rate is 2.7% (World Bank 2007a), while the average age is 19.9 yrs (World Factbook 2007).

History of Environmental Issues

Belize environmental problems date to 2000 BC, as a result of soil erosion impacts caused by Mayan farming (Dunning and Beach 1994). The Mayan population in historic Belize was actually larger than the current population of the country (1×10^6 vs. 2.9×10^5 ; Association for Belizean Archaeology 2007), contributing to considerable soil erosion and sediment deposition called “Mayan Clay” in area rivers and streams (Dunning and Beach 1994). Soil erosion was accelerated by the Mayan “swiden” maize production technique (Steinburg 1998). Swiden production, also called “slash and burn” agriculture, involves removing canopy cover and other vegetation in order to plant crops. Thus, swiden agriculture contributes to soil erosion by increasing the effects of runoff from heavy tropical rains through elimination of the cushioning and absorption characteristics of natural vegetation.

The economy of colonial era Belize was composed largely of timber harvesting, beginning with trees cut for dye manufacturing (*Haematoxylum campechianum*, Armstrong 2008) and turning to mahogany (*Swietenia* spp.) logging for shipbuilding and cabinet making as markets evolved (Nationmaster 2007). Logging remained a major financial component of the economy well into the 20th century.

Historical and Geographical Trends

Historically, the capital was located in Belize City. The capital was moved to the more inland area of Belmopan in 1970 after hurricane Hattie ravaged Belize City in 1961 (Encyclopedia Britannica Online 2007b). Belize City is still the largest city, with a population of approximately 70,000 (Belize Discover 2007). This population center is located near the major farming area of the country (the north central region, World Factbook 2007) which is farmed largely by Mennonite immigrants (Young 2007a). At this time, the more southerly areas do not have the infrastructure to support a large population (Honey 2006).

Also, 96% of the landscape is classified as something other than arable land (World Factbook 2007), and is composed mostly of forest land of various types (Young 2007a). In fact, Belize has the highest percentage of land area in protected forest reserves in Latin America (35%, FAO 2000).

Biodiversity and Deforestation

Belize has a great deal of biological diversity, including many vascular plant (3408), bird (576), mammal (> 150), and fish species (\approx 600, BERDS 2007). Among this

diversity are several threatened species, including five mammals and three birds (World Bank 2007b, IUCN 2008). Much of Belizean total diversity is associated with the barrier reef that is just off shore; this reef is the largest reef in the western hemisphere (PACT 2006) and the largest living reef in the world (Young 2007a). It is 290 km long and contains 240 islands or cays. In addition to the many vascular plant and fish species found at the reef, there are also 65 stony coral species and 350 mollusk species (Encyclopedia Britannica Online 2007a).

Annual deforestation rates average 2.3% (Butler 2007). Deforestation reached a rate of 9000 ha annually in 1980 (Grainger 1993). Causes of deforestation include forestry, conversion to farmland, and urbanization (Green 2000). Deforestation is particularly heavy along the rivers (11%, Butler 2007), where the majority of the villages are located (Young 2007a). Economics are a factor in the deforestation rate, as forested land has not had a high monetary value (\$0.60 per acre, Litterer 1997).

Soils Erosion and Desertification

Modern Mayans often utilize the swiden agriculture system of their ancestors, contributing to soil erosion problems associated with deforestation (Steinburg 1998). This process involves clearing forest trees to plant crops, which leaves little vegetation to impede and absorb surface water from rainfall. Thus, top soil is removed and stream sediment load is increased. The poor soils of such areas are quickly depleted of nutrients, forcing the farmers move on to another area.

Other modern activities, such as sugar, citrus, and banana plantation farming, also contribute to soil erosion. These activities degrade the soil through several mechanisms,

including soil compaction and the leaching of nutrients. Soil degradation has reached the degree of desertification in some areas, especially un-rehabilitated and exposed gravel pits, due to desiccation (Green 2000).

Air Pollution

Belize has very little urban air pollution, largely due to the relative lack of sulfur emissions most often attributed to motor vehicle emissions (Gaylarde *et. al.* 2007). However, Belize does produce nearly three metric tons of air pollution per capita per year overall (World Bank 2007c). This is about 1/6th of Australia's emission level (18 metric tons per capita per year, World Bank 2007c). There is no listing for industrial air pollution in the literature (Earthtrends 2003, World Factbook 2007).

Water Pollution

Industry consumes approximately 95 million m³/yr of water per year, more than any other single factor (FAO 2000). Domestic consumption amounts to 260 liters per day per capita in urban areas, while rural consumption is 160 liters per day per capita.

Agriculture irrigation amounts to less than 1% of annual consumption.

Belizeans are aware of water pollution because of two issues. First, the marine environment is affected by both solid waste and other pollution. Solid waste washes onshore, making resort areas unsightly and potentially influencing tourism recruitment (Slean 2006). Also, increased nutrient content from human activities affects marine ecology, as it has been speculated to be a factor in coral reef ecological drift (MacClanahan and Muthiga 1998). Second, the majority (70%) of the drinking water in

Belize is surface water, only 30% of which is treated (FAO 2000), making it susceptible to contamination and thus an avenue for the spread of waterborne disease.

Groundwater quality is of concern especially during the dry season, as some areas such as the Corozol District have had high hardness and sulphate levels (FAO 2000). There has also been evidence of chloride contamination in some inland wells and in waters along the coast (FAO 2000).

Of note from the water pollution perspective is the lack of an in-depth water quality analysis from the Belize River, which is of concern because the Macal tributary of the Belize River is the site of both the Challilo and Mollejón hydroelectric dams (FAO 2000).

Solid Wastes

Belize's number one environmental problem is the management of solid waste (Zerbock 2003). Daily waste production is approximately 1.1 Kg per capita, amounting to some 181,437 metric tons annually (Roches 2007). For comparison, New Jersey residents annually produce some 1905 Kg of solid waste each (NJDEP 2007), while urban residents of Mexico produce from 2.6 to 3.7 Kg of waste per day (Medina 2000). This waste is composed largely of organic components (60%), 20% of which is paper. Ship-bound tourism contributes to waste problems as well, as the cruise ships often dump their waste overboard into sensitive marine areas (Slean 2006). Additionally, tourists contribute to land based waste problems when they dock and travel inland for activities (Young 2007b).

There are two main waste disposal issues in Belize; the inadequacy of the existing landfill near Belize City and the random dumping of waste in rural areas (Roches 2007). This waste often accumulates in streams and rivers (Roches 2007), possibly contributing to the spread of water borne illness.

Toxic and Radioactive Wastes

Belize does not have nuclear reactors (Nationmaster 2007), thus avoiding that waste disposal problem. However, Belize does annually produce 600,000 tons of “Industrial Waste” (Yourke 2006), which pose a threat to the water supply due to unrestricted disposal (FAO 2000).

Soil samples reveal dangerously high levels of lead, averaging 445 ppm but ranging up to 5450 ppm (Reeder and Shapiro 2003). These levels are highest in samples from housing areas of Belize City, averaging 638 ppm.

Environmental-health related issues

The availability of clean drinking water is of importance to the environmental health of Belize today. Belizean water can be contaminated by sewage, parasites, and toxic runoff which contribute to the proliferation of waterborne illnesses such as gastroenteritis and cholera (BVSDE 2007). The number of water treatment facilities is increasing, although approximately 18% (as of 1999) of the rural population still does not have access to treated water (BVSDE 2000).

Public Opinion, Education on Environmental Matters

Training, professional opportunity, and funding for Belizean students in the environmental sciences are limited (Young 2008). However, education efforts are increasing the environmental awareness of the general population (Major Accomplishments 2006), including the Mayan peoples, although their current participation in the environmental decision making processes is limited (Shal 2003). Up to 88% of the Belizean population favors existing eco-tourism standards (Lindburg *et. al.* 1996), a trend which reflects the economic importance of the activity, despite the environmental risks (Honey 2006).

Non-government Organizations

There are several environmentally oriented non-government organizations (NGOs) operating in Belize, the first of which was the Belize Audubon Society (Belize Audubon Society 2007). Formed in 1969, the Belize Audubon Society actively manages various reserves including the Cockscomb Jaguar Reserve, provides environmental education, and assists in the conservation process by recommending important focus areas for preservation (Belize Audubon Society 2007).

Other important NGOs in Belize include the Society for the Promotion of Education and Research (SPEAR), the Programme for Belize, and the Toledo Institute for Development and Environment (TIDE). SPEAR promotes democracy and sustainable development (FAO 2007), while the Programme for Belize promotes conservation, encourages the wise use of resources, and manages Belize's largest private reserve (Programme for Belize 2003). Finally, TIDE focuses on the research and implementation

of environmentally sustainable economic initiatives of the Toledo district, as well as co-managing Payne's Creek Natural Park and other areas (TIDE 2005).

Environmental Legislation

There are two main laws that establish and regulate protected areas in Belize. First, the Crown Land Ordinance (1924) enabled the Minister to create "crown reserves" on an ad hoc basis (IUCN 1992). The oldest crown reserve thus established is Half Moon Cay, which was designated in 1928 (IUCN 1992). The second major law concerning protected areas was the National Parks System Act No. 5 (1981), which allowed for the establishment of national parks and other protected areas (IUCN 1992). This law has been updated with the completion of the Belize National Protected Areas System Plan (Meerman and Wilson 2005).

There are a number Belizean laws pertaining to solid waste, including the Solid Waste Management Authority Act of 1991 (revised 2000b, Government of Belize) which established a solid waste collection service. Also, the Environmental Protection Act of 1992, which was also revised in 2000, prohibited dumping and set standards on the disposal of hazardous waste (Government of Belize 2000a). There are also local government refuse laws (Roches 2007), designed to prevent illegal dumping in specific areas.

Another regulation of significance is the Environmental Impact Assessment Regulation of 1995 (ELAW 2002), which was created to manage the environmental impact of logging (Government of Belize 1999). This law has been challenged by the difficulty of enforcement in remote areas (Litterer 1997).

Conclusion

Belize is a country of immense beauty and diversity, both cultural and ecological. Belize has shown an increasing environmental awareness, and has acted to preserve its natural heritage by establishing a multitude of protected areas. The country currently faces the environmental issues of waste disposal and deforestation. However, Belize has invested in conservation and tourism, and possesses a wealth of natural resources. Hopefully, with proper planning and wise use of both natural and human resources, Belize will be able to develop a sustainable economy while also preserving a rich natural heritage.

Acknowledgements

The author would like to thank Aldemaro Romero and Carolyn Miller for reviews of this manuscript. Thanks also to Matthew Connior for access to various research documents.

Literature Cited

Armstrong, W. 2008. Logwood and brazilwood: trees that spawned 2 nations.

Accessed May 2008. <http://waynesword.palomar.edu/ecoph4.htm>

Association for Belizean Archaeology. 2007.

<http://ambergiscaye.com/pages/mayan/mayasites.html>

Belize Audubon Society. 2007. Belize Audubon Society: History. Accessed Oct. 2007.

<http://www.belizeaudubon.org/history.htm>

Belize Discover. 2007. Belize City. <http://www.belizediscover.com/BelizeCity.htm>

Biological and Environmental Resource Data System of Belize (BERDS). 2007.

- Species. Accessed Oct. 2007. <http://www.biodiversity.bz/find/species/>
- Butler, Rhett. 2007. Deforestation rates in Belize: Statistics for Belize. Accessed Oct. 2007. <http://rainforests.mongabay.com/>
- BVSDE. 2000. Evaluación de los servicios de agua potable y saneamiento 2000 en las Américas: Belice. Accessed Oct. 2007. Organización Panamericana de la Salud. <http://www.bvsde.ops-oms.org/eswww/eva2000/belice/informe/inf-07.htm>
- Central Intelligence Agency. 2007. Central America and the Caribbean. www.central_america_map_cia.gov.pdf
- Dunning, N. and T. Beach. 1994. Soil erosion, slope management, and ancient terracing in the Mayan lowlands. *Latin American Antiquity* 5(1): 51-69.
- Earthtrends. 2003. Earthtrends Country Profiles, Belize. http://earthtrends.wri.org/pdf_library/country_profiles/cli_cou_084.pdf
- Encyclopedia Britannica Online. 2007a. Belize barrier reef. Accessed Oct. 2007. <http://www.britannica.com/eb/article-9106223>
- Encyclopedia Britannica Online. 2007b. Belmopan. Accessed Oct. 2007. <http://www.britannica.com/eb/article-9015308/Belmopan#148671.hook>
- Environmental Law Alliance Worldwide (ELAW). 2002. Belize- Environmental impact assessment regulations, 1995-- Statutory Instrument No. 107 of 1995. Accessed Oct. 2007. <http://www.elaw.org/resources/text.asp?ID=936>
- Food and Agriculture Organization of the United Nations (FAO). 2000. FAO's information system on water and agriculture: Belize. FAO. Accessed Oct. 2007. <http://www.fao.org/nr/water/aquastat/countries/belize/index.stm>
- Food and Agriculture Organization of the United Nations (FAO). 2004. Socio-economic

trends and outlook in Central America: Implications for the forestry sector to 2020. Accessed Nov. 13, 2007.

<http://www.fao.org/docrep/006/j2459e/j2459e00.htm>

Food and Agriculture Organization of the United Nations (FAO). 2007. Jamaica, Bahamas, and Belize: Sustainable development. Accessed Oct. 2007.

http://www.fao.org/world/jamaica/links_en.asp?subj=2&nav=Sustainable%20Development

Gaylorde, C. C., B. O. Ortega-Morales, and P. Bartolo-Pérez. 2007. Biogenic black crusts on buildings in unpolluted environments. *Current Microbiology* 54(2): 162-166.

Government of Belize. 1999. Ministry of the Environment press release: With the onset of the dry season and the expected increase in corresponding logging activities, the Forest Department takes this opportunity to advise timber operators and the general public of the following existing regulations... Accessed Oct. 2007.

http://www.governmentofbelize.gov.bz/press_release_details.php?pr_id=154

Government of Belize. 2000a. Environmental protection act: Chapter 328. Accessed Oct. 2007.

http://www.oas.org/dsd/FIDA/laws/legislation/belize/belize_epa-328.pdf

Government of Belize. 2000b. Solid waste management authority act: Chapter 224. Accessed Oct. 2007.

http://www.thecommonwealth.org/Shared_ASP_Files/UploadedFiles/3CB12F10-20EC-4D31-B3FC-5FC4B21FE0_SolidWasteManagementAuthorityAct1991.pdf

- Green, E. D. 2000. Belize's first national report on the implementation of the United Nations Convention to combat desertification (UNCCD) 2000. Accessed Oct. 2007. Forest department ministry of natural resources, environment, and industry: Belize.
- <http://www.unccd.int/cop/reports/lac/national/2000/belize-summary-eng.pdf>
- Honey, M. 2006. Cruise tourism in Belize: perceptions of economic, social, and environmental impact: conclusions and recommendations. CESDTIES, Washington, D.C. April 18, 2006. Accessed May 2008.
- <http://ecotourismcesd.org/webarticles/articlefiles/42-Conclusions%20&%20Recommendations.pdf>
- IUCN. 1992. Belize. *In* Protected areas of the world: a review of national systems. Volume 4: nearartic and neotropical. IVth World Congress on National Parks and Protected Areas. Caracas, Venezuela. p 119 –126.
- IUCN. 2008. 2008 Red List of Threatened Species. Accessed May 2008.
- <http://www.iucnredlist.org/info/tables/table5>
- Lindburg, K., J. Enriquez, K. Sproule. 1996. Ecotourism questioned: Case studies from Belize. *Annals of Tourism Research* 23(3): 543-563.
- Litterer, J. 1997. ICE Case Study No. 12: Belize logging conflict. Accessed Oct 13, 2007. American University, The School of International Service. Washington, DC. <http://www.american.edu/ted/ice/belize.htm>
- MacClanahan, T. R. and N. A. Muthiga. 1998. An ecological shift in a remote coral atoll of Belize over 25 years. *Environmental Conservation* 25: 122–130.
- Major Accomplishments: 2005 - 2006. 2006. Ministry of the Environment and Natural

- Resources. Belize.
- Medina, M. 2000. Globalization, development, and municipal solid waste management in third world cities. El Colegio de la Frontera Norte, Tijuana, Mexico.
- http://www.gdnet.org/pdf/2002AwardsMedalsWinners/OutstandingResearchDevelopment/martin_medina_martinez_paper.pdf
- Meerman, J. C. and J. R. Wilson. 2005. The Belize National Protected Areas Systems Plan. Accessed May 2008.
- <http://www.biodiversity.bz/find/resource/profile.phtml?dcid=23430>
- Nationmaster.com. 2007. Central America and the Caribbean > Belize.
- <http://www.nationmaster.com/country/bh-belize>
- New Jersey Department of Environmental Protection (NJDEP). 2007. Living with the future in mind goals and indicators for New Jersey's quality of life first annual update to the sustainable state project report 2000. Accessed Oct. 2007.
- <http://www.state.nj.us/dep/dsr/sustainable-state/40.htm>
- Programme for Belize. 2003. About Programme for Belize. Accessed Oct. 2007.
- <http://www.pfbelize.org/about.html>
- Protected Areas Conservation Trust (PACT). 2006. PACT: Belize. Accessed Oct. 2007.
- <http://www.pactbelize.org/>
- Reeder, P. and L. Shapiro. 2003. Lead Contamination of Soils in Belize City, Belize, Central America. Journal of Environmental Science and Health, Part A 38: 2785 – 2805.
- Roches, A. Publishing date unknown, accessed Oct. 2007. Solid waste management: the

- current state in Belize.
- http://www.epa.gov/lmop/conf/ca_workshop/SolidWasteBelize.pdf
- Shal, V. 2003. Environment, development and indigenous people –Belize. Indigenous rights in the commonwealth Caribbean and Americas regional expert meeting. Amerindian Peoples' Association (APA), Guyana.
- Slean, Geraldine. 2006. Perceptions of cruise tourism's economic, social & environmental impact: qualitative results. Belize City, Belize. Accessed Oct. 2007. CESD.
- <http://ecotourismcesd.org/webarticles/articlefiles/42-Qualitative%20Results.pdf>
- Steinburg, M. K. 1998. Agroforestry practices among the Mopan Maya in southern Belize. *Professional Geographer* 50(4): 407-417.
- Toledo Institute for Development and Environment (TIDE). 2005. Accessed May 2008.
- <http://www.tidebelize.org/about.html>
- Young, C. 2007a. Belizean creole ethnobotany: Species richness and diversity patterns of ethnobotanically useful species in Belizean lowland tropical rainforest. Arkansas State University Lecture Series, Jonesboro, Arkansas.
- Young, C. 2007b. Mother Nature's Best Kept Secret': Opportunities for research in Belize. Arkansas State University Lecture Series, Jonesboro, Arkansas.
- Young, C. 2008. Belize's ecosystems: threats and challenges to conservation in Belize. *Tropical Conservation Science* 1(1): 18-33.
- Yourke, Violet. 2006. National concerted effort to manage Belize's waste. Ministry of Natural Resources and the Environment. Accessed Oct. 2007.
- http://www.governmentofbelize.gov.bz/press_release_details.php?pr_id=4513

World Bank. 2007a. Belize data profile. The World Bank Group. Accessed October 13, 2007.

<http://devdata.worldbank.org/external/CPProfile.asp?PTYPE=CP&CCODE=BLZ>

World Bank. 2007b. Belize environment indicators. The World Bank Group Accessed Oct. 2007.

<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTDATA/0,,contentMDK:21052167~pagePK:64168445~piPK:64168309~theSitePK:2875751,00.html>

World Bank. 2007c. Data, environment, Belize. The World Bank Group. Accessed Oct. 2007.

<http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20394745~menuPK:1192714~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html>

World Factbook. 2007. Belize.

<https://www.cia.gov/library/publications/the-world-factbook/geos/bh.html>

World Health Organization. 2005. Belize: Summary country profile for HIV/AIDS treatment scale-up. Accessed Oct. 2007. http://www.who.int/hiv/HIVCP_BLZ.pdf

Zerbock, O. 2003. Urban solid waste management: Waste reduction in developing nations. *In* CE 5993 Field Engineering in the Developing World. Michigan Technical University.

Figure 1 Map of Belize.



<http://maps.google.com/maps?ll=17.189877,-88.49765&z=8&t=h&hl=en>

Table 1 Major ethnic components of the human population of Belize, 2007.

<u>Ethnicity</u>	<u>Percent</u>
Mestizo	48.7
Creole	24.9
Maya	10.6
Garifuna	6.1
Other	9.7

Source: World Factbook, 2007.