

---

# THE STATE OF GLOBAL FORESTS

## KEY QUESTIONS

- Why are forests important?
- Where do we need forested areas to protect biodiversity?
- How do present forests compare to prehistoric forests?
- What are trends in changes in forest cover?
- How do tropical forests, temperate forests, and boreal forests differ?
- Can forests help mitigate climate change?
- How do consumer practices threaten global forests?
- What practices can help restore and protect forests?

## INTRODUCTION

Most people know that we are rapidly losing tropical forests. A study by the World Resources Institute<sup>1</sup> (WRI) concluded that over half of the original planetary forest cover, or about 3 billion hectares, has been lost due to human activity, and we continue to lose forest at a rate of about 16 million hectares a year. For comparison, the total forest area of Canada is about 418 million hectares.

Forty percent of the planet's remaining forests are frontier forests. Frontier forests, as defined by WRI, have large contiguous areas with limited human influence and can sustain biodiversity levels without human interference. Other kinds of modern forests, such as pine monocultures, have undergone so much human alteration that they have diversity levels much reduced from prehistoric times. Large predators, for example, require extensive tracts of contiguous habitat and can't survive in fragmented forest.

Almost half of the world's forest has been replaced by agriculture, pasture, or settlement over the past 8,000 years. From 1850 to 1990 alone, deforestation released over 120 billion metric tons of carbon into the atmosphere, initiating the present episode of accelerated global climate change.

**Question 20-1:** What was the historic rate of forest loss over this 8,000-year interval, in percent per year?

---

<sup>1</sup> [www.wri.org](http://www.wri.org).

According to the Nature Conservancy, “[As of 2005] every second, a slice of rainforest the size of a football field is mowed down. That’s more than 56,000 square miles of natural forest lost each year.”<sup>2</sup>

**Question 20-2:** Based on an original global forest area of 6 billion hectares, what is the rate of forest loss per year, as of 2005?

In Brazil alone between 2000 and 2005, 3.1 million hectares of forest were cut down per year. However, due partly to government regulations and partly to a drop in worldwide soybean demand, the deforestation rate in Brazil fell by 75% between 2004 and 2012.<sup>3</sup>

**Question 20-3:** Compare the total forest loss in Brazil during 2000–2005 to Canada’s total forest.

For Indonesia the deforestation rate was 1.85 million hectares per year.

**Question 20-4:** The U.S. had about 750 million acres of forest in 2000. Compare the total forest loss in Indonesia between 2000–2005 to the total U.S. forest cover.

## WHY PROTECT FORESTS?

Why is it important that we restore and preserve intact forest ecosystems?

- Even fragmented forests help maintain biodiversity.
- Forests store immense amounts of carbon and thus help moderate the greenhouse effect and global climate change.
- Forests provide billions of dollars worth of economic services, such as wood products, herbs, medicines, and other raw materials.
- Forests can protect water supplies, clean the air of pollutants, moderate severe weather like hurricanes, and provide recreational facilities and solitude.
- Because forests can generate precipitation and can even create their own climate, as in the rainforests of the tropics.
- Because at least 60 million people live in intact forests and depend on them for a livelihood.
- Because it is the right thing to do, in terms of our responsibilities to future generations.

<sup>2</sup> The Nature Conservancy, <http://www.nature.org/ourinitiatives/urgentissues/rainforests/rainforests-facts.xml>.

<sup>3</sup> *Science*, <http://news.sciencemag.org/scienceinsider/2010/09/deforestation-rate-continues-to.html>.



**FIGURE 20-1** Recently developed strip mall along Highway 17 bypass in Pawleys Island, South Carolina. The site had been a small pine forest prior to construction of the store “Primarily Pine” and others. (D. Abel)

**Question 20-5:** Figure 20-1 shows a strip shopping center in Pawleys Island, SC. The site (including the land occupied by the store “Primarily Pine”) was a small pine ecosystem before the land was completely cleared. In similar cases, developers have responded to criticism about their land-clearing practices by arguing that the forest was in fact fragmented and already disturbed (i.e., not pristine), that we must balance the economy and the environment, and/or the land was private property and the developer had the right to develop it. Evaluate the developers’ responses. Discuss whether you agree or disagree.

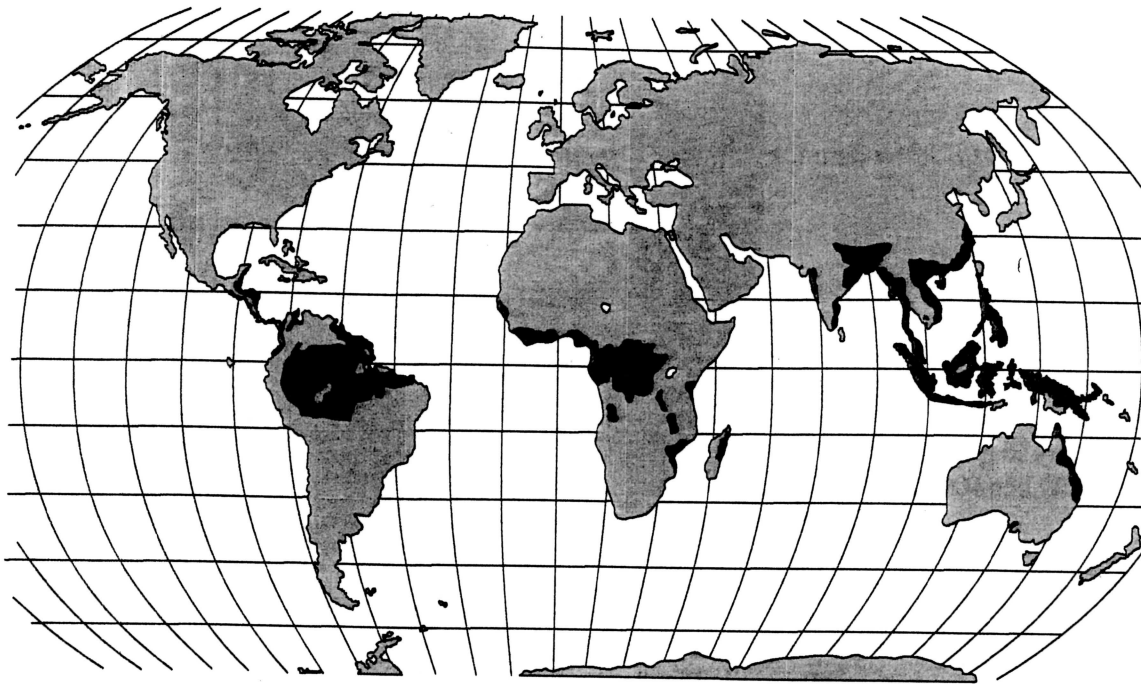
## THREE CLASSES OF GLOBAL FORESTS

There are three types of global forest communities, based roughly on latitude, but defined by seasonality:

- *Boreal* forests, at polar latitudes and high elevations anywhere
- *Temperate* forests, at mid-latitudes
- *Tropical* forests, at frost-free equatorial latitudes

### Tropical Forests

Figure 20-2 shows the global extent of tropical rainforest. Daylight is roughly constant year round, there is no frost, and precipitation is heavy. Soils are generally poor, easily depleted of nutrients, and tend to be acidic, making large-scale western-style agriculture difficult. Precipitation often exceeds 200 centimeters per year. Flora is very diverse. One hectare may contain dozens of plant species.



**FIGURE 20-2** The extent of global tropical rainforest (darkened areas).

Alarmist rhetoric can perhaps be anticipated from some environmental activists. However, here is the U.S. National Aeronautics and Space Administration (NASA):<sup>4</sup>

The loss of tropical forest is more profound than mere destruction of beautiful areas. If the current rate of deforestation continues, the world's rainforests will vanish within 100 years, causing unknown effects on global climate and eliminating the majority of plant and animal species on the planet.

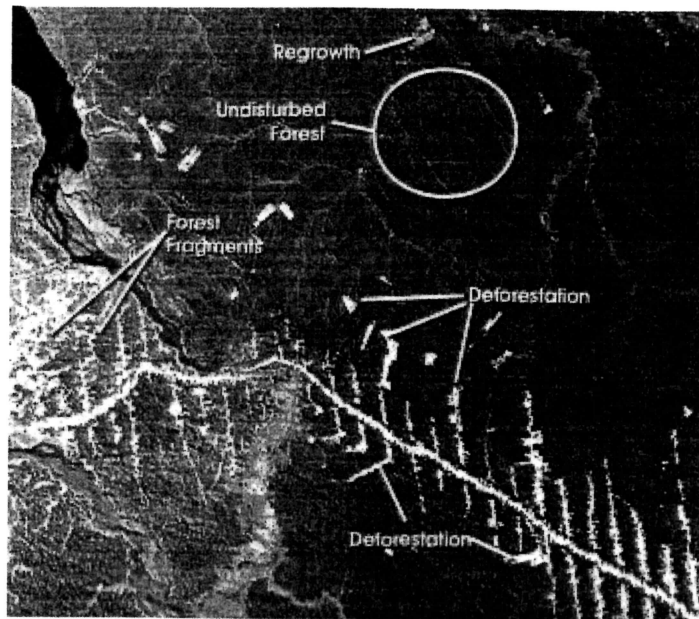
**Question 20-6:** Identify the effects of population growth on tropical deforestation, both in the home country and abroad.

Deforestation is occurring for a number of reasons:

- Commercial logging
- Livestock raising, mainly cattle
- Food and fuel crops, both subsistence and commercial

Some deforestation is driven by debt. Some countries owe billions of dollars to foreign lenders and must either pay interest on that debt or default. Commercial logging provides revenue to pay foreign lenders. Deforestation may also be driven by poverty and ignorance. In Bolivia, which controls part of the Amazon rainforest, annual GDP is about \$4800 per capita (it was \$48,000 for the U.S. in 2011) and 51% of the populace lives on less than the

<sup>4</sup> NASA: [www.earthobservatory.nasa.gov/Library/Deforestation](http://www.earthobservatory.nasa.gov/Library/Deforestation).



**FIGURE 20-3** Deforestation in the Brazilian rainforest. (NASA)

equivalent of \$2 (U.S.) per day.<sup>5</sup> Mines and hydroelectric dams, often built using foreign loans, may destroy, contaminate, or flood thousands of hectares of rainforest. Roads and settlements also contribute to deforestation, roads perhaps most importantly, since roads provide access to miners, loggers, and desperate farmers. Figure 20-3, a part of the Brazilian rainforest, shows how deforestation commonly occurs. This pattern generates isolated areas called “forest fragments,” in which plant and animal species are disturbed. Alien species are commonly introduced along roads by vehicles. Humans using roads may then harvest animals in the forest for “bush” meat, one of the fastest growing sources of protein in equatorial Africa.

***Bush meat, logging, and deforestation in African rainforests.*** Killing of forest animals including endangered primates for food has become epidemic in African rainforests. There are four key concepts involved in understanding and addressing this issue.<sup>6</sup>

1. The bush meat “crisis” is the most immediate threat to wildlife populations in Africa.
2. Human population growth, illegal hunting methods, logging, and road building are essential components of the crisis.
3. Forests over much of west and central Africa are literally being emptied of their wildlife by illegal hunting.
4. Solutions to this problem require international action.

The economics of the African bush meat issue are sobering. More than 30 million people live in central African forests, and they eat approximately 30 kilograms of bush meat, mainly large mammals, per capita annually as of 2009.

<sup>5</sup> CIA World Factbook, [www.cia.gov](http://www.cia.gov).

<sup>6</sup> [www.bushmeat.org](http://www.bushmeat.org).

**Question 20-7:** How much bush meat in total is “harvested” from central African rainforests annually, in metric tonnes?

Consider the Democratic Republic of the Congo, where the 2011 per capita income was around \$300, ranking 226th (last) on the U.S. CIA’s global list.<sup>7</sup> A bush meat hunter can make more than \$300 annually hunting and selling bush meat. The population of 73.6 million people (2012) is growing at 3 percent per year.

**Question 20-8:** What is the doubling time for this population? (Use  $t = 70/r$ ; see “Using Math in Environmental Issues,” pages 6–8.)

**Question 20-9:** What is your long-term forecast for the survival of the Congolese rainforest and its megafauna should these population projections prove accurate?

### Temperate Forests

Temperate forests, at mid-latitudes of both the northern and southern hemispheres, have well-defined seasons with several frost-free months. Flora is less diverse than in tropical forests, with fewer tree species per hectare.

However, in the United States, due to fire suppression techniques applied beginning in the 19th century, many temperate forests have “too many trees.” For example, research suggests that pre-colonial New Mexico temperate forests had perhaps a dozen trees per acre. Now, there may be ten times as many, leading to disastrous fires. This overabundance of trees has another unintended consequence: much of the precipitation is returned to the atmosphere by the thick tree canopy, depriving the soil of much-needed moisture.<sup>8</sup>

Varieties of temperate forests include southeastern (U.S.) pine forests, Pacific Northwest conifer-dominated rainforests, and Mediterranean forests with rainy winters and very dry summers. Little original temperate forest remains on Earth. For example, less than 1 percent of Europe’s original temperate forest remains.

<sup>7</sup> CIA op cit.

<sup>8</sup> *The Economist*. <http://www.economist.com/blogs/babbage/2012/06/forest-management>.

One distinctive characteristic of temperate forests is the size of its largest trees. A Douglas fir in Washington's Olympic Peninsula was 420 feet tall when chopped down in 1895. Some redwoods in California forests stand over 300 feet tall.

One-quarter of the Earth's remaining temperate rainforest is in British Columbia, Canada, and adjacent southeastern Alaska. Over half of these forests have already disappeared. It is home to at least 3,000 distinct wild Pacific salmon runs. Its integrity, if not its very survival, is threatened by clear-cut industrial logging.

Canada's 30,000-member David Suzuki Foundation has undertaken a scientific analysis of the needs of this ecosystem.<sup>9</sup> It has concluded that logging but not industrial clear-cut logging can be compatible with ecosystem integrity. It has proposed a set of principles to guide logging activity in this irreplaceable resource. These principles could well be applied to almost any type of natural resource extraction activity. They are as follows:

1. The fundamental goal of management should be ecosystem health, not economic gain.
2. All local activities should be consistent with protecting ecosystem integrity.
3. The cut rate must be low enough to sustain the integrity of the entire ecosystem.
4. Indigenous people and other local stakeholders' views must be central to planning and decision making.
5. All native plant and animal species must be preserved.
6. Waterbodies—the adjacent marine environment and all rivers, streams, wetlands, and lakes—are vital for the health of the ecosystem and must be protected without degradation.
7. Determining what to retain is more important than what to remove. The view of some loggers that much vegetation in forests is “trash”—“trash trees,” for example—is a view borne out of ignorance and has no place in ecosystem management.
8. Ecological restoration must be incorporated into decision making at all levels.
9. Apply the precautionary principle (see page 14) in all decisions affecting logging activity.

**Question 20-10:** Select three of the nine principles and critique them using a critical thinking approach (pages 8–12). Are there any of the entire list that you would delete? Modify? Are there any that you would add? Explain.

### Southern Forests

In the early 1600s, as much as 350 million acres of undisturbed forests, an area nearly the size of Texas, California, and Montana combined, blanketed the southern U.S. Virtually none of this remains pristine: 99% of southern forests have been cut in the last 400 years. The majority of southern forests are *commercial* forests, typically meaning rows of loblolly pines or other fast-growing trees scattered among recently harvested clear cuts. Known as *tree plantations*, these areas may superficially resemble forests, but they are *monocultures* (composed of a single kind of tree), their biodiversity is not as high as that of undisturbed,

<sup>9</sup> David Suzuki Foundation. [www.davidsuzuki.org](http://www.davidsuzuki.org).

natural forests, and they do not provide the same levels of ecosystem services (e.g., erosion protection, storage of carbon dioxide) that natural forests provide and on which humans depend.

Natural forests in the southern United States contain some of the most biologically rich ecosystems in North America. Many of the region's plant and aquatic species can be found nowhere else in the world. According to the Dogwood Alliance's Scot Quaranda, Southern forests contain<sup>10</sup>

- The highest concentration of tree species diversity in North America;
- The highest concentration of aquatic diversity in the continental United States, including the richest temperate freshwater ecosystem in the world; and
- The highest concentration of wetlands in the United States, 75 percent of which are forested.

"Nowhere in America is there a greater variety of native plant communities, native plant species, or rare and endemic plants."<sup>11</sup>

Here are more facts about southern forests:

- Approximately 6 million acres of the South's forests are logged every year, largely to make paper.
- Removals of softwoods (pines) exceed growth throughout the region.
- Removals of all species exceed growth on industry land in the region.
- Logging is expected to increase 50 percent by the year 2040.
- Removals of hardwoods are projected to exceed growth by 2025.

A 2010 study, *Quantification of Global Gross Forest Cover Loss*, in the journal *Proceedings of the National Academy of Sciences*, reports that forest loss in the southeast U.S. is among the highest globally.<sup>12</sup> According to the U.S. Forest Service, the South produces more timber than any other single country in the world. It is projected to be the dominant producing region for many decades to come. The South accounts for 15% of the world's paper supply. This industry is driving the destruction of our forests through industrial-scale clear-cutting, and the conversion of forests and wetlands to intensively managed tree plantation monocultures. As of 2009, 43 percent of southern forests were "sterile pine plantations" requiring millions of pounds of pesticide applications each year.<sup>13</sup>

An emerging threat to southern forests is logging for biomass as an energy source. *Biomass* is a catchall term for a variety of energy sources derived from organic matter, including high-yield grasses (e.g., switchgrass), food crops (corn, sugarcane), landfill methane, food waste, and wood (also known as *forest biomass*). Biomass is generally considered an attractive alternative to fossil fuels because it promotes energy security, decreases foreign oil dependence, contributes to a green economy, and is thought to contribute less to climate change. Increasing demand for forest biomass for domestic use and export to Europe is changing the nature of forest biomass use in the southeast from low-impact, small-scale, Mom-and-Pop operations that rely on waste from sawmills and other logging residues, to an industrial scale that demands harvest of large stands of whole, standing trees.

This shift in turn has led to increased scientific scrutiny of the environmental impact, particularly the key assertion that the use of forest biomass is *climate neutral*. Climate neutrality means that combusting wood releases carbon dioxide that will once again be stored in the forest when it regrows, and that this cycle will result in no net addition of carbon dioxide to the atmosphere over long periods.

<sup>10</sup> Dogwood Alliance, [www.dogwoodalliance.org](http://www.dogwoodalliance.org) and personal communication.

<sup>11</sup> U.S. Forest Service (USFS).

<sup>12</sup> Available at <http://www.pnas.org/content/107/19/8650.full>.

<sup>13</sup> USFS, *ibid*.



A recent report commissioned by the National Wildlife Federation (NWF) and Southern Environmental Law Center (SELC), *Biomass Supply and Carbon Accounting for Southeastern Forests*,<sup>14</sup> rigorously analyzed the climate change assumption. The study's conclusion: Yes, burning forest biomass recycles carbon dioxide over a period from 35–50 years, after which there is a net benefit, but in the short term there is a net increase in carbon dioxide released into the atmosphere so that any long-term benefit will be too late to avoid the worst impacts of climate change. Other scientific studies have calculated that carbon dioxide balance may take a century or more. Moreover, mature, natural forests are better storehouses of carbon dioxide than tree farms.

**Question 20-11:** Propose ways to reduce the destruction of southern forest ecosystems.

### Boreal Forests

Boreal forests, also called “taiga,” cover over 1 billion acres of Siberia, Scandinavia, and northern Canada.<sup>15</sup> Found roughly at 50 to 60 degrees north latitude, boreal forests have nutrient-poor, acidic soils and are characterized by short growing seasons and severe winter conditions. *Permafrost* characterizes much of the boreal realm. This permanently frozen soil may store huge quantities of methane. Boreal forests are dominated by hardy coniferous varieties, like spruce and fir.

Although most popular focus is on threats to tropical forests, intensive logging in boreal forests may result in their disappearance in one or two generations without careful management. The boreal region may contain up to one-third of terrestrial carbon, according to the Polaris Project.<sup>16</sup> To what extent intact boreal forests survive will depend on actions taken by two countries: Russia and Canada.

**Russian boreal forests.** Russia has the largest mass of boreal forest on Earth but little effective protection of its remaining boreal forests, outside of a few small nature areas and national parks. Low prices for lumber in Russia compared to adjacent countries like Finland contribute to indiscriminate forest loss. Deforestation in Russia may reach 20,000 km<sup>2</sup> (1 km<sup>2</sup> = 100 ha) annually, similar to the annual deforestation rate in the Amazon Basin of Brazil. Here is one summary of the importance of Russian forests from the Woods Hole Research Center.<sup>17</sup>

Russian forests contain approximately 56.3 billion tonnes of carbon (bmtC) in vegetation, and about 135.7 bmtC in soil organic matter. Earth's circumpolar boreal forests and associated bogs (peatlands) contain at least five times the carbon of the world's temperate forests, and twice the carbon in tropical forests. Approximately 60% of the C is presently in permafrost. In short, Russia holds nearly half of the Northern hemisphere's terrestrial carbon. Thus, “Russia's natural forest resources play an integral role in global carbon cycling and climate change.”

<sup>14</sup> Available at: <http://www.southernenvironment.org/uploads/publications/biomass-carbon-study-FINAL.pdf>.

<sup>15</sup> World Resources Institute. [www.wri.org](http://www.wri.org).

<sup>16</sup> Polaris Project, [www.polarisproject.org](http://www.polarisproject.org).

<sup>17</sup> [www.whrc.org](http://www.whrc.org).

**Question 20-12:** Would you be in favor of a global fee or surcharge on paper or wood products to help protect Russian boreal forests? Why or why not?

**Question 20-13:** Should protecting global carbon stores be entirely a national (in this case, Russia's) responsibility, given the integration of global economies? Comment, and suggest alternatives.

**Canadian boreal forests** The Canadian boreal forest is the single largest ecosystem on the North American continent. It makes up more than a third of Canada, yet less than 3 percent is protected from industrial logging, mining (including oil and gas development), or hydro development, the three greatest threats to the boreal forest. As of 2006, Canada was one of the world's largest exporters of forest products, exporting \$39 billion (\$C) and the United States was by far its biggest customer. However, China may overtake the United States in the global marketplace, and Russia could be that nation's supplier of choice.

Oil and gas exploration is a little-appreciated threat to the integrity of Canada's forest, through the laying of many thousands of kilometers of seismic lines, which require cutting a swath through the forest.

As to the future, here are the findings of a report prepared by the Boreal Forest Network:<sup>18</sup>

- Canada's forests are managed mainly for timber, but the public values the forests mainly for nontimber use.
- Nearly a third of the forest is within one kilometer of a road.
- Half of Canada's boreal forest is owned by a few large timber companies.
- At least 300 hydroelectric dams and sixty large, active mines operate within the boreal zone.
- About 1% of Canadian boreal forest is logged each year, and the preferred method is clearcutting.
- 90% of logging in Canada occurs within primary and old-growth forests—forests of high biodiversity and wilderness value.

The Boreal Forest Network concludes,

(S)olutions to protect . . . the boreal forest of North America must first include a coordinated campaign in both the U.S., as the primary consumer nation, and Canada. This campaign would be designed . . . to influence both Canadian and U.S. Consumers . . . about the underlying causes of deforestation and the social and economic impacts it has had on communities living in the boreal eco-zone, as well as the global impacts associated with current large-scale resource extraction practices.<sup>19</sup>

<sup>18</sup> [www.borealnet.org](http://www.borealnet.org).

<sup>19</sup> *Ibid.*

**Question 20-14:** What responsibilities, if any, do American consumers have to protect Canadian boreal forests? What form could such activity take?

## GLOBAL FORESTS AND JUNK MAIL

Junk mail is the popular term for what the U.S. Postal Service calls “standard” mail. It consists mainly of unsolicited advertising circulars and mailings. While Americans receive about 5 million tons of junk mail a year, the Direct Marketing Association reports that nearly half of junk mail is discarded unread. Moreover, it costs localities \$1 billion each year to dispose of junk mail. Seventeen trees are needed to make a ton of paper. Six and a half million tons of paper are used each year to produce junk mail.<sup>20</sup>

**Question 20-15:** There are about 310 million Americans. How many pounds of junk mail on average does each American receive?

**Question 20-16:** Since at least 44% of junk mail is discarded unread, how many trees are thrown away each year in unread unsolicited junk mail?

## GLOBAL FORESTS AND DISPOSABLE PAPER CUPS

U.S. consumers used 16 billion paper cups in 2006.

If only 50 customers a day in every store were to use reusable mugs, Starbucks would save 150,000 disposable paper cups daily. This equals 1.7 million pounds of paper, 3.7 million pounds of solid waste, and 150,000 trees a year.<sup>21</sup>

Each Starbucks paper cup weighs on average almost 0.7 ounce. That’s about 24 paper cups to the pound.

Dan Welch, owner of Portland Oregon’s World Cup Coffee, said that the average 16-ounce paper cup and cardboard sleeve, including artwork, plastic lid, and stir stick, costs more than 22 cents to produce.<sup>22</sup> This cost, of course, does not include disposal. Starbucks

<sup>20</sup> [www.donotmail.org](http://www.donotmail.org).

<sup>21</sup> Starbucks Inc, [www.starbucks.com](http://www.starbucks.com).

<sup>22</sup> [www.portlandmercury.com](http://www.portlandmercury.com).

is, as one observer said, merely “the tip of the iceberg.” Fast-food giants like McDonald’s, Burger King, Wendy’s, 7-11, and Jack-in-the-Box are responsible for far more disposable cup waste than the coffee shop chain. For example, McDonald’s<sup>23</sup> used more than 451,000 tons of packaging in 2003, a 12 percent increase over 2002. About 41 percent was paperboard, the raw material for paper cups.

**Question 20-16:** How much paperboard did McDonald’s use in 2003?

**Question 20-17:** Using the value 24 cups per pound and 16 billion cups used in 2006, how many pounds of paperboard did this represent?

**Question 20-18:** Given these glimpses into the amount of wood products used in paper cups and junk mail, assess the importance of education and small lifestyle changes in protecting global forests.

**Question 20-19:** Is your current use of forest products consistent with the goals of sustainability? In what ways might you alter your use of forest products to slow the destruction of forests globally?

**Question 20-20:** Summarize the major points of this Issue.

<sup>23</sup> McDonald’s Corp., [http://www.aboutmcdonalds.com/mcd/sustainability/library/policies\\_programs/sustainable\\_supply\\_chain/Environmental\\_Scorecard.html](http://www.aboutmcdonalds.com/mcd/sustainability/library/policies_programs/sustainable_supply_chain/Environmental_Scorecard.html)