

1. In your own word, summarize Thomas Malthus' arguments about population growth.

Ans: Malthus essentially argued that any increase in the standard of living would be short-lived because people would have more children which would lead to an increase in the population. The additional demand on food supply would lead to a decrease in the standard of living.

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2. Suppose a country starts with a population of about 34 million people. To simplify, assume that 50% of the population is female and that the only way people die is through old age. If the total fertility rate is 1.66, what is the population in three generations?

Ans: There are 34 million people, half of which have 1.66 children on average meaning that at the end of generation one, there are 28.2 million people  $[(23,000,000 \div 2) \times 1.66]$ . If half of this population has 1.66 children on average, then at the end of the second generation there are 23.4 million people, and at the end of the third generation there are 19.4 million people. *(In 2009, the Canadian population was approximately 34 million and the TFR was approximately 1.66.)*

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3. Suppose a country starts with a population of about 1.4 billion people. To simplify, assume that 50% of the population is female and that the only way people die is through old age. If the total fertility rate is 1.7, what is the population in four generations?

Ans: There are 1.4 billion people, half of which have 1.7 children on average meaning that at the end of generation one, there are 1.19 billion people  $[(1,400,000,000 \div 2) \times 1.7]$ . If half of this population has 1.7 children on average, then at the end of the second generation there are 1.01 billion people, at the end of the third generation there are 860 million people, and at the end of generation four there are 731 million. *(In 2009, the Chinese population was approximately 1.4 billion and the TFR was approximately 1.7.)*

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4. Suppose the world starts with a population of about 6.8 billion people. To simplify, assume that 50% of the population is female and that the only way people die is through old age. If the total fertility rate is 2.3, how many generations will pass before there are 10 billion?

Ans: There are 6.8 billion people, half of which have 2.3 children on average meaning that at the end of generation one, there are 7.8 billion people  $[(6,800,000,000 \div 2) \times 2.3]$ . If half of this population has 2.3 children on average, then at the end of the second generation there are 9.0 billion people, at the end of the third generation, there are 10.3 billion people.

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5. Economists have noted that as living standards improve there is often a decrease in the total fertility rate. Nevertheless, there is often a sudden population increase shortly after economic conditions improve. Was Malthus correct? Explain.

Ans: Malthus' theory was based on a population increase from a higher number of births, so strictly speaking, his theory was incorrect. Nonetheless, it is often the case that there is a population increase shortly after living standards have improved. This is because while improved nutrition and healthcare lower the number of deaths, it takes a while for parents to realize that large families are not necessary to ensure the "right" number of children survive until adulthood. Once parents adjust to the new demographic reality, the total fertility often rate drops.

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6. What are some reasons that the total fertility rate has dropped so low in industrialized economies? What sort of policies are governments enacting in an attempt to increase the fertility rate, and have they been effective?

Ans: Demographers have been surprised by the significant drop in fertility rates in industrialized countries; often these rates fall significantly below the replacement rate. Explanations for this drop in the TFR include changing attitudes toward religion, expanded career opportunities for women, and the rising cost of raising high-quality children in a modern economy.

As a response to these low fertility rates, governments have offered cash payments to families having more than one child, income tax breaks for families with children, extended maternity/family leave, free/subsidized daycare, and specialized education savings plans. To date, these policies have not generated any sustained increase in fertility.

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7. In 1968, Paul Erlich made an argument similar to that of Malthus. Obviously his predictions did not come true. Why?

Ans: Paul Erlich predicted mass starvation in the hundreds of millions in the 1970s and 1980s. This prediction was not realized in part due to the declining fertility rates associated with increases in the standard of living and because the supply of productive resources available for goods and services production has increased faster than the demand for those resources.

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8. What are two sources of increase in demand for world commodities since 1850?

Ans: Since 1850, the world's population has increased from just over 1 billion to well over 6 billion which has meant a significant increase in demand for resources. Moreover, the increase in standard of living has meant an increase in the consumption per person. More people, each wanting more resources means a significant increase in demand placed on the world's resources.

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9. What has happened to world commodity prices since 1850? Why?

Ans: Since 1850 world commodity prices have fallen rather dramatically. Population increase combined with increasing per capita consumption has meant a significant increase in resource demand which would tend to drive up prices. In order for prices to fall then, the growth in demand must have been outstripped by a growth in supply.

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Learning Objective: 14.1

10. Explain and evaluate this statement: "While the predictions of Malthus have not come true, this does not mean there will not be local resource shortages."

Ans: The dire predictions of Malthus and similar-thinking individuals (e.g., Paul Erlich) have not been realized. Declining birth rates coupled with increased global supply has permitted at least some of the world to realize continuously increasing standards of living. What is true globally is not necessarily true locally. Water is scarce in the American Southwest and in the Middle East. Localized food shortages are a common problem. So, while the larger problem of running out of resources does not seem likely, there are local issues that must be dealt with.

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Learning Objective: 14.1

11. Why is it important to understand “peak demand” when we study the economics of energy generation?

Ans: Cheap electricity often requires large scale plants operating at-or-near full capacity in order to exploit economies of scale. Peak demand only occurs during part of a day, or for part of a year. The high fixed cost of large scale plants that will operate below-capacity during non-peak periods means it is not necessarily cost-efficient to build a single large plant. Often it makes more sense to build a large plant to meet regular electricity demand and a smaller plant (or plants) – with lower fixed costs but higher operating costs – to meet peak demands.

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12. Suppose an electric power company adopted a system of “peak-load pricing” in which electricity cost more when demand was high (e.g., during the day) and cost less when demand was low (e.g., at night). What might be the effect of this policy on customer demand? How might this help the efficiency of the electric power company?

Ans: Electricity consumers, responding to peak-load pricing would shift some of their energy consumption to evening hours when electricity prices are lower. This has the effect of smoothing electricity consumption throughout the day and thus reducing the peak demand. Given peak demand electricity is often generated at high cost, the effect at the electric power company can be a lowering of costs.

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13. Suppose a community has an evening electricity demand of 60 megawatts and a peak daytime demand of 85 megawatts. Explain why building a 100 megawatt generator may not be the most cost-effective solution to this community’s electricity needs.

Ans: Large generating stations have prohibitively large fixed costs and require operation at-or-near full capacity to exploit economies of scale. A 100 megawatt generation station would certainly meet peak demand, but would often be used well-below its full capacity. This makes running such a power plant an expensive option. Instead, the community might find it cheaper to build a 60 megawatt plant that runs continuously and a smaller 25-30 megawatt plant that produces higher-cost energy but only for a small portion of the day.

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14. Evaluate the claim, “The world is running out of energy.”

Ans: This claim is an exaggeration. “The world is running out of *cheap* energy,” is more reasonable. As coal and oil supplies get low, or their prices increase dramatically in an effort to deal with climate change, other energy sources like natural gas, oil shale, wind, bio-mass, solar radiation, and so on will become economically viable. Right now, these energy sources are not cheap relative to traditional fossil fuels today, but one day they will be.

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15. Some people worry that we are running out of oil. Why are economists less worried about this prospect?

Ans: As oil supplies dwindle, people expect the price of oil to rise, perhaps quite dramatically. Given the prevalence of oil as a source of energy, lubrication, and manufacture (e.g., plastic), people are quite worried about this potential price increase. Economists however, realize that what really matters is relative price. As oil prices rise, substitutes become relatively less expensive. Economists predict that people and firms will shift to using these substitutes. In fact, as demand for these substitutes’ increases, we may very-well see economies of scale develop in their manufacture. {This is part of the policy objective behind Germany’s feed-in tariff energy policy – see [http://en.wikipedia.org/wiki/Feed-in\\_tariff](http://en.wikipedia.org/wiki/Feed-in_tariff) for an overview.}

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16. What is meant by net benefit?

Ans: Net benefit is the amount by which the benefits of some action or policy exceed the costs. In resource economics, it often means the difference between current costs and the present value of future expected benefits.

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17. What is the difference between renewable and non-renewable resources?

Ans: Renewable resources are resources that replenish themselves (e.g., trees, aquifers, and animals) or resources that are difficult to imagine depleting (e.g., wind, and solar radiation). Non-renewable resources are resources that can be “used up” so that once they are gone we will not get them back (except in geologic time). Examples include fossil fuels and minerals.

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18. Evaluate this statement: “Coal, oil, and natural gas are natural fuels but they are non-renewable.”

Ans: This is a reasonable statement. For the most part, the creation of coal, oil, and other fossil fuels is a natural process that takes place in geologic time. While these fuels may eventually replace themselves, it is unlikely to happen before our grandchildren’s grandchildren’s grandchildren walk the earth.

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19. Suppose the current profit on a barrel of oil is \$65 per barrel. If profit per barrel is expected to increase to \$80 in 5 years and the interest rate is 3%, then what should the company do?

Ans: The present value of a benefit,  $B$ , received  $t$  years in the future when the interest rate is  $r$  is calculated as  $B_{PV} = B_t / (1+r)^t$ . The current profit is \$65. The present value of \$80 in 5 years at 3% is \$69.01 [ $\$80 / (1.03)^5$ ]. The future sale of oil is worth more than the current value [ $\$69.01 > \$65$ ] so the company should wait to sell the oil.

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20. Suppose the current profit per tonne of coal is \$105 but it is expected to rise to \$110 in 3 years. If the interest rate is 5%, what do you expect the company to do? How would your answer change if the interest rate was 3%?

Ans: The present value of a benefit,  $B$ , received  $t$  years in the future when the interest rate is  $r$  is calculated as  $B_{PV} = B_t / (1+r)^t$ . The current profit is \$105. The present value of the higher profit of \$120 in 3 years at 5% is \$103.66 [ $\$120 / (1.05)^3$ ] and at 3% is \$109.82 [ $\$120 / (1.03)^3$ ]. At an interest rate of 5%, the company is better-off selling the coal now as the present value of the higher profits is less than the current profits [ $\$103.66 < \$105$ ]. However, at an interest rate of 3% it makes more sense for the company to wait as the present value of the higher profits exceeds the current profit [ $\$109.82 > \$105$ ].

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21. A company is looking at investing \$1,000 per hectare to plant seedlings. They expect that if they harvest the trees in 50 years, they can sell each hectare of harvested wood for \$20,000 and in 100 years for \$150,000. Which project, if either, would the company engage in if the interest rate was 4%, or 6%?

Ans: The present value (PV) of a benefit,  $B$ , received  $t$  years in the future when the interest rate is  $r$  is calculated as  $B_{PV} = B_t / (1+r)^t$ . We can calculate the net present value by subtracting the cost of planting from present value of the different benefits.

Timeframe	Cost	4%		6%	
		PV	NPV	PV	NPV
<b>50 years</b>	\$1,000	\$2,814.25	\$1,814.25	\$1,085.77	\$85.77
<b>100 years</b>	\$1,000	\$2,970.00	\$1,970.00	\$442.08	-\$557.92

Firms are interested in maximizing the net present value (NPV). At 4%, it makes the most sense for the company to plan on a 100 year harvest. Notice however, that at 6%, the company maximizes NPV at a 50-year harvest. In fact, at 6% the company loses money if it waits for 100 years.

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22. A company is looking at investing \$2,500 per hectare to plant seedlings. They expect that if they harvest the trees in 75 years, they can sell each hectare of harvested wood for \$110,000. However, if the company invests another \$1,800 now, and sprays herbicide on the newly planted ground, they can kill the deciduous growth and increase yield so that the value of the harvest increases to \$145,000 in 75 years. Suppose the interest rate is 4%.

- (a) Does the initial (no-spray) investment make sense?
- (b) Does it make sense for this company to spray?

- (c) Are there any potential problems that might arise in this scenario?

Ans: (a) The present value (PV) of a benefit,  $B$ , received  $t$  years in the future when the interest rate is  $r$  is calculated as  $B_{PV} = B_t / (1+r)^t$ . We can calculate the net present value by subtracting the cost of planting from present value of the benefits. The net present value of the no-spray option is \$3,306.20 [ $\$110,000 / (1.04)^{75} - \$2,500$ ]. Because the NPV is greater than zero, it makes sense for the company to follow this option.

(b) If the company engages in spraying, future profits rise to \$145,000, but now planting and spraying costs are \$4,300 [ $\$2,500 + \$1,800$ ]. The NPV of this option is \$3,353.63 [ $\$145,000 / (1.04)^{75} - \$4,300$ ]. Notice that this exceeds the NPV of the no-spray option, so it is likely that the company will choose to spray.

Another way of looking at the problem is to calculate the NPV of spraying. Profit increases by \$35,000 [ $\$145,000 - \$110,000$ ] while costs are increased by \$1,800. The NPV of this part of the project is \$47.43 [ $\$35,000 / (1.04)^{75} - \$1,800$ ] which indicates it adds value to the overall project.

(c) If there are external costs associated with the spray (e.g., if the chemicals leach into well-water) then while it makes sense for the company to engage in spraying, it may not be an optimal economic decision for the community as a whole.

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23. What is user cost?

Ans: User cost is the cost to the user of extracting a resource; it is the present value of the profits forgone by using the resource today rather than waiting to sell it at a later date.

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24. Suppose that the market price for a tonne of coal is \$65. Dusty Mining owns a mine with an expected production life of 2 years. The company's marginal extraction costs (EC) are listed in the table below. Assume the present value of forgone year-two profits (at current market prices) is \$10 per tonne. Complete the table below and answer the following questions.

Quantity (x10 tonnes)	EC	User Cost	Total Cost
1	35	_____	_____
2	45	_____	_____
3	55	_____	_____
4	65	_____	_____
5	75	_____	_____

- (a) How much coal would Dusty Mining extract if it did not consider the user cost of extraction?
- (b) Once the company takes the present value of next year's forgone profits into account, how much would it extract this year?
- (c) Suppose that market reports indicate that the price of coal will increase next year. How might this affect Dusty Mining's current extraction?

Ans:

Quantity (x10 tonnes)	EC	User Cost	Total Cost
1	35	10	45
2	45	10	55
3	55	10	65
4	65	10	75
5	75	10	85

- (a) Dusty Mining would equate the market price of \$65 to the marginal extraction cost. This occurs at a quantity of 40 tonnes.
- (b) A rational forward-looking company would account for both current and future profit opportunities. As such, Dusty Mining should equate market price to the total costs of extraction which includes forgone profit opportunities (user cost). In this instance, extraction this year would drop to 30 tonnes.
- (c) Higher future prices would mean higher profits in the future. In other words, the user cost would increase thereby increasing total cost and reducing current extraction. For instance, if user cost increased by a further \$10 per tonne, then current extraction would drop to 20 tonnes.

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25. Suppose that the market price for a tonne of coal is \$60. Big Holes owns a mine with an expected production life of 2 years. The company's marginal extraction costs (EC) are listed in the table below. Assume the present value of forgone year-two profits (at current market prices) is \$15 per tonne. Complete the table below and answer the following questions.

Quantity (x10 tonnes)	EC	User Cost	Total Cost
1	25	_____	_____
2	30	_____	_____
3	35	_____	_____
4	40	_____	_____
5	45	_____	_____
6	50	_____	_____
7	55	_____	_____
8	60	_____	_____
9	65	_____	_____
10	70	_____	_____
11	75	_____	_____
12	80	_____	_____

- (a) How much coal would Big Holes extract if it did not consider the user cost of extraction?
- (b) Once the company takes the present value of next year's forgone profits into account, how much would it extract this year?
- (c) Suppose that the current price of coal decreased to \$50 per tonne but future forgone profits remained the same. How would this affect current extraction?
- (d) If Big Holes expected this price drop in (c) above to be permanent, what would be the likely effect on current extraction as compared to (c)?

Ans:

Quantity (x10 tonnes)	EC	User Cost	Total Cost
1	25	15	40
2	30	15	45
3	35	15	50
4	40	15	55
5	45	15	60
6	50	15	65
7	55	15	70
8	60	15	75
9	65	15	80
10	70	15	85
11	75	15	90
12	80	15	95

- (a) Big Holes would equate the market price of \$60 to the marginal extraction cost. This occurs at a quantity of 80 tonnes.
- (b) A rational forward-looking company would account for both current and future profit opportunities. As such, Big Holes should equate market price to the total costs of extraction which includes forgone profit opportunities (user cost). In this instance, extraction would drop to 50 tonnes this year.
- (c) If current prices dropped, but did not affect user cost, then Big Holes would equate the new price (\$50) to total extract cost and extract 30 tonnes this year.
- (d) If the price drop was permanent, then user cost would drop as future profits would be lower. This would lower total extraction costs and mean an increase in extraction as compared to the 30 tonnes of coal when the price decrease seemed temporary.

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26. Suppose that the market price for an ounce of gold is \$900. Dig-it Inc., owns a mine with an expected production life of 2 years. The company's marginal extraction costs (EC) are listed in the table below. Assume the present value of forgone year-two profits (at current market prices) is \$200 per ounce. Complete the table below and answer the following questions.

Quantity (x1,000 oz)	EC	User Cost	Total Cost
1	600	_____	_____
2	700	_____	_____
3	800	_____	_____
4	900	_____	_____
5	1000	_____	_____
6	1100	_____	_____
7	1200	_____	_____

- (a) How much gold would Dig-it extract if it did not consider the user cost of extraction?
- (b) Once the company takes the present value of next year's forgone profits into account, how much would it extract this year?
- (c) Suppose ongoing worries of a recession drive gold prices up to \$1,100 an ounce. If the present value of future expected profits remains unchanged, what amount of gold will Dig-it extract? Compare this to the amount you found in (a)?
- (d) Suppose that the government announces that next year, Dig-it will lose its mining rights and will have to cease operations. How will this affect their current extraction at a price of \$1,100 per ounce?

Ans:

Quantity (x1,000 oz)	EC	User Cost	Total Cost
1	600	200	800
2	700	200	900
3	800	200	1000
4	900	200	1100
5	1000	200	1200
6	1100	200	1300
7	1200	200	1400

- (a) Dig-it would equate the market price of \$900/oz to the marginal extraction cost. This occurs at a quantity of 4,000 ounces.
- (b) A rational forward-looking company would account for both current and future profit opportunities. As such, Dig-it should equate market price to the total costs of extraction which includes forgone profit opportunities (user cost). In this instance, extraction this year would drop to 2,000 ounces.

- (c) If gold prices increased to \$1,100/oz, Dig-it would equate the new market price to the total cost (marginal extraction cost plus user cost) and extract 4,000 ounces. This is the same amount as in answer (a).
- (d) If Dig-it knows that it will lose mining rights, it is no longer in the company's best interest to think about future profits. In other words, the user cost drops to zero and the marginal extraction cost becomes the total cost. At a price of \$1,100/oz and no prospect of future mining, Dig-it will extract 6,000 ounces this year.

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27. Critically evaluate, "All mining companies want to do is get in, dig up their minerals, and leave as fast as possible."

Ans: This statement is not correct. While mining companies are looking to make money, and there are a number of external costs associated with mining, these companies do have long-term interests at heart. As long as marginal extraction costs are increasing and they can expect future profits, it pays for a mining company to reduce some extraction now in order to shift extraction to the future.

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28. Why is there such large variation in the rate of change in forest cover across nations?

Ans: While there are a large number of reasons for these differences, economists believe that property rights play a significant role in forestry management and sustainability of this renewable resource. In some nations, forests and woodlots are privately-owned, strictly regulated as state-property, or some combination of these two regimes. When well-defined property rights exist, it is in the owners' best interests to manage the forest in a reasonably sustainable manner. When property rights are ill-defined, significant deforestation is often the result. *{If instructors assign this as a take-home question or for an assignment, have students check out the following website <http://svs.gsfc.nasa.gov/goto?2640> which shows the dramatic difference in forest cover between Haiti and the Dominican Republic.}*

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Learning Objective: 14.4

29. Why are overfishing and fishery collapse so common these days?

Ans: Population increase has contributed to growing demand and technological improvements have increased harvests beyond a number of fisheries' ability to maintain stock size. The largest problem however, is a lack of property rights in ocean fisheries. For the most part, the only way to establish property rights over a fish in the open ocean is to catch and kill it. {To see updated numbers on fisheries exploitation, visit <ftp://ftp.fao.org/docrep/fao/011/i0250e/i0250e.pdf> and see pages 30-42}

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30. Define total allowable catch (TAC).

Ans: Total allowable catch (TAC) is a fisheries policy that sets an overall weight-cap that fishermen can collectively catch of some particular species of fish in a given season.

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Learning Objective: 14.4

31. Define individual transferable quotas (ITQs).

Ans: Individual transferable quotas limit the total weight of some particular species of fish an individual fisherman (or company) can catch in a given season. Owners of an ITQ are permitted to sell their quota to others.

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Learning Objective: 14.4

32. What are two policies economists favour in order to curb overfishing?

Ans: Economists favour both the total allowable catch (TAC) and individual transferable quotas (ITQs). The TAC is a policy that caps the amount of fish that can be caught. An ITQ system caps the number of fish that can be caught, but permits fishermen to trade away their quota if the price is right, which can improve economic efficiency.

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33. How can a total allowable catch (TAC) policy lead to an “arms race?”

Ans: A TAC policy limits the total amount of fish caught by a fleet but it does not state who can catch these fish. Each fisherman has the incentive to build bigger and faster boats so as to be able to catch and carry the most fish as fast as possible. This competition to catch a limited number of fish increases costs, reduces profits, and thus reduces economic efficiency.

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34. Suppose the market price of mackerel is \$2.50/kg. Both Yousef and Anna have received individual quotas of 50,000 kg. Yousef has older equipment and has a cost of \$1.10/kg, whereas Anna, in her newer boat, has a cost of just \$0.90/kg.

(a) What profits do Yousef and Anna earn when they are not permitted to trade their quota?

(b) What profit could each fisherman earn if Yousef sold his entire quota to Anna for \$1.44/kg.

Ans: (a) Yousef has revenues of \$125,000 [ $2.5 \times 50,000$ ] and costs of \$55,000 [ $1.10 \times 50,000$ ] for a profit of \$70,000 [ $125,000 - 55,000$ ]. Anna has revenues of \$125,000 and a cost of \$45,000 [ $0.90 \times 50,000$ ] for a profit of \$80,000. Total profits in this case are \$150,000 [ $70,000 + 80,000$ ].

(b) If Yousef sells his entire quota of 50,000 kg to Anna at a price of \$1.44/kg, he earns \$72,000 [ $1.44 \times 50,000$ ]. Anna, now with a quota of 100,000 kg earns revenues of \$250,000 [ $2.50 \times 100,000$ ] and incurs costs of \$90,000 [ $0.90 \times 100,000$ ] plus the \$72,000 spent to purchase Yousef's quota. Her profit is \$88,000 [ $250,000 - 90,000 - 72,000$ ]. Total profits in this case are \$160,000 [ $72,000 + 88,000$ ]. {Notice that the combined profit increase of \$10,000 [ $160,000 - 150,000$ ] is equal to the difference in the costs, \$0.20/kg [ $1.10 - 0.90$ ], times the size of the quota being exchanged, 50,000kg.}

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Learning Objective: 14.4

35. Suppose the market price of Chilean sea bass is \$1.60/kg. Both Juanita and Don have received individual quotas of 40,000 kg. Juanita has older equipment and has a cost of \$1.00/kg, whereas Don, in his newer boat, has a cost of just \$0.75/kg.

(a) What profits do Juanita and Don earn when they are not permitted to trade their quota?

(b) What profit could each fisherman earn if Juanita sold her entire quota to Don for \$0.70/kg.

Ans: (a) Juanita has revenues of \$64,000 [ $\$1.60 \times 40,000$ ] and costs of \$40,000 [ $\$1.00 \times 40,000$ ] for a profit of \$24,000 [ $\$64,000 - 40,000$ ]. Don has revenues of \$64,000 and a cost of \$30,000 [ $\$0.75 \times 40,000$ ] for a profit of \$34,000. Total profits in this case are \$58,000 [ $\$24,000 + 34,000$ ].

(b) If Juanita sells her entire quota of 40,000 kg to Don at a price of \$.70/kg, she earns \$28,000 [ $\$0.70 \times 40,000$ ]. Don, now with a quota of 80,000 kg earns revenues of \$128,000 [ $\$1.60 \times 80,000$ ] and incurs costs of \$60,000 [ $\$0.75 \times 80,000$ ] plus the \$28,000 spent to purchase Juanita's quota. His profit is \$40,000 [ $\$128,000 - 60,000 - 28,000$ ]. Total profits in this case are \$68,000 [ $\$28,000 + 40,000$ ]. {Notice that the combined profit increase of \$10,000 [ $\$68,000 - 58,000$ ] is equal to the difference in the costs, \$0.25/kg [ $\$1.00 - 0.75$ ], times the size of the quota being exchanged, 40,000kg.}

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Learning Objective: 14.4

36. What role do property rights play in the use of both non-renewable and renewable resources?

Ans: Property rights play a very important role in both non-renewable and renewable resource management. When property rights are poorly defined or poorly enforced, then a company has no incentive to conserve non-renewable resources because there is little certainty about the company's ability to reap future profits. Similarly, ill-defined or unenforced property rights means there is little incentive to sustainably manage a renewable resource. As an example, consider the collapse of the North Atlantic cod stock.

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Learning Objective: 14.3, 14.4



37. Does economic growth inevitably mean environmental decline?

Ans: While it may seem to be the case that through the process of economic growth the environment suffers, the data does not agree with the anecdotal evidence. Per capita income and the environmental performance index (EPI), produced by the Yale Center for Environmental Law and Policy, show a strong positive relationship. Higher per capita incomes explain about 70 percent of the between-country difference in EPI scores. *{Instructors should note that in the latest release from the Yale Center for Environmental Law and Policy (2010), while the Nordic countries have maintained their high-80's scores, Canada has dropped from a score of 84.0 as mentioned in the text, to 66.4 (ranked 46 out of 163). The United States is currently ranked 61 out of 163 with a score of 63.5 (<http://epi.yale.edu/>).}*

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Learning Objective: Last Word

Answer