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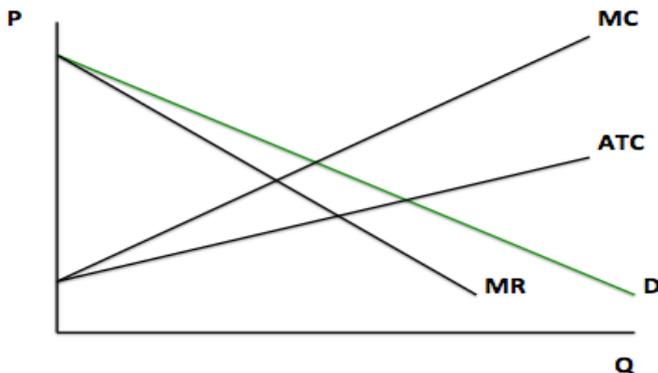
Student #:

This exam is worth 160 points. Please read it carefully before starting. It is divided into three parts. Please answer the questions in the exam booklets provided.

Part I. Multiple Choice (2 points each)(10)

Please read carefully. There is one answer for each question.

- Which of the following is an example of derived demand?
 - When the price of tablets decreases, demand for newspapers decreases
 - When the demand for lumber increases, the price of lumber goes up
 - When demand for newsprint fall, demand for pulplogs decrease
 - When an importing country imposes a tax on lumber imports, domestic lumber prices go up in that country
- An increase in demand when supply is highly inelastic will lead to (relative to the old market equilibrium):
 - A large increase in the market quantity and much higher price
 - A large increase in the market quantity and a small increase in price
 - A small increase in the market quantity and a small increase in price
 - A small increase in the market quantity and much higher price
- The optimal rotation will decrease when:
 - Interest rates decrease
 - Lumber prices decrease
 - Reforestation costs increase
 - None of the above
- A firm has established a monopoly over the supply of a recently popularized eco-certified newsprint. In the graph below, please identify the area that represents the firm's profit:



- The following is not an example of a market-based mechanism used to correct externalities:
 - Cap and trade systems
 - Payments for environmental services
 - Subsidies
 - Mandatory standards

6. Which of the following is an example of decreasing returns to scale:
- The firm doubles inputs and outputs increase by 50%
 - The firm increases inputs by 20% and outputs increase by 20%
 - The firm increased inputs by 20% and outputs increase by 40%
 - The firm doubles inputs an outputs more than double
7. Which of the following is not a risk to forestry associated with Climate change?
- Increased mortality from forest pests and diseases
 - Wildfire
 - Maladapted trees
 - trade warfare with the US
8. Using Figure 2 below, identify market equilibrium under conditions of perfect competition
- a*
 - b*
 - c*
 - d*
 - none of the above

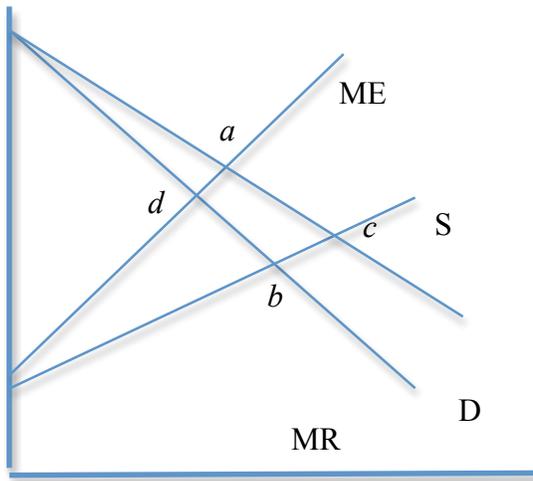
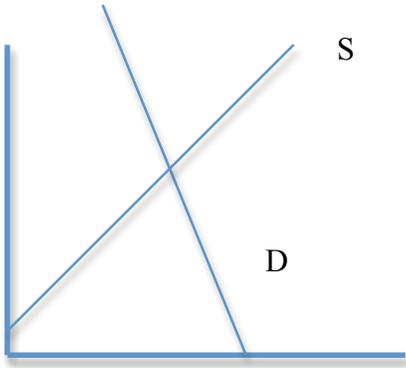


Figure 2.

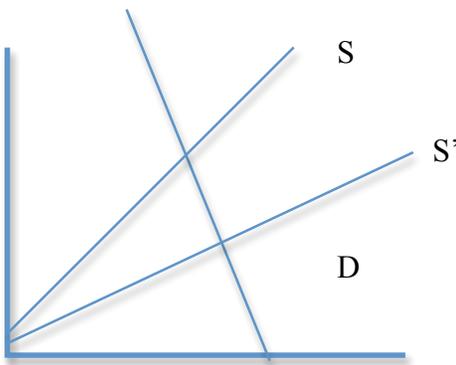
9. Using the same figure, identify the market equilibrium under conditions of monopsony
- a*
 - b*
 - c*
 - d*
 - none of the above
10. The free rider problem is associated with:
- Timber bidding
 - Negative externalities
 - Oligopolies
 - Public goods

Part II. Short Answer (10 points each)(6)

Question 1. Scientists have been working on Genomic technology that will increase the productivity of native species. The effect will be to shift the timber supply curve in Panel A out from S to S' as shown in Panel B. They will make the technology freely available to forest sector firms in Canada. Will Canadian firms adopt the technology? Why or why not? (Note: these are not genetically modified trees so there are no GMO issues associated with their introduction.)



Panel A.



Panel B.

Question 2.

You are managing forestland in the Fraser Valley on private land. The Caring Coffee Company in Kits wants to be carbon-neutral and has approached you. They are willing to buy a carbon offset from you. You have two options if you did want to provide an offset: there is some land that you could reforest, while you also have some timber scheduled be harvested this year for which you could postpone harvest ten years. Table 1 shows your costs, anticipated harvest revenues, and carbon revenues from the different projects, all evaluated on a per hectare basis, shown today (PV) and ten years from now (FV) (when you will get paid for the Carbon). Should you provide an offset? Why or why not? If yes, which kind?

Table 1. Returns from afforestation, timber harvesting, and postponing harvest (\$/ha)

	afforest		Harvest now		Postpone harvest	
	PV	FV	PV	FV	PV	FV
costs	\$1,000.00	\$1,628.89	\$3,000.00	\$4,886.68	\$2,210.09	\$3,600.00
carbon revenues	\$736.70	\$1,200.00	\$-	\$-	\$613.91	\$1,000.00
harvest revenues	\$-	\$-	\$4,000.00	\$6,515.58	\$2,578.44	\$4,200.00

Question 3. Bullwhistle BC is preparing a plan for its community forest. Their forester has laid out a harvesting plan that will generate 50,000 cubic metres next year, and estimates that stumpage will average \$5 per cubic metre and net profits to the town will be \$4 per cubic metre. The loggers come from Bullwhistle, and they estimate that the total wages associated with logging 50,000 cubic metres will be \$1 million. One vocal group of homeowners are protesting the harvesting, claiming that it will negatively affect their viewscapes and quality of life.

a) Assuming that all the loggers that would have harvested the community forest will be able to find equivalent work and wages logging elsewhere, and the community forest is not concerned about making the homeowners happy (they are very timber-centric), how much would the homeowners have to offer the town such that they would be willing not to log?

b) Is this socially optimal?

Question 4. It is the end of the logging season and Able Logging Firm has been successful in winning a timber sale. It is now looking more closely at what it owns, and realizes there are two distinct types of timber stands in the sale site, where the proportion of low-grade material is much higher for one stand and lower for the second, and some of the costs and values also vary. Table 2 shows the values, costs, and volume associated with each site along with the stumpage they have to pay for the high and low grade timber (all of the material is considered merchantable).

Table 2. Quantities, revenues and costs for two different timber stands in a timber sale (\$/m³)

Timber stands	A		B	
	high	low	high	low
quantity (m ³)	100	20	60	60
average log value (\$/m ³)	90	20	70	20
harvest cost (\$/m ³)	50	50	30	30
haul cost (\$/m ³)	15	15	7.5	7.5
barging cost (\$/m ³)	10	10	10	10
stumpage cost (\$/m ³)	10	0.25	10	0.25

a) How much should Able harvest from each site and take to market? (note: the same rules as in the timber bid assignment also apply here in terms of utilization where firms must harvest and pay stumpage on all merchantable timber but need not take it to market)

b) Will they make money? Show, explain, or justify why or why not (you can't just say yes or no!)

Question 5. You are in charge of a forestry crew consisting of 10 workers, each paid \$10 per hour, and are carrying out a restoration project that involves generating thinnings for biomass that will be sold to the nearby pulp mill. They are willing to provide \$20/tonne. Table 3 shows how many tonnes each crew member can individually generate from how much time they spend working on each hectare of forest.

Table 3. Production of biomass by crew member

Hours	Cumulative tonnes	additional tonnes per hour of labour
1	3	3
2	5.8	2.8
3	8.2	2.4
4	10	1.8
5	11.5	1.5
6	12.5	1
7	13.00	0.5
8	13.25	0.25

a) How much time should they spend on each hectare?

b) Ignoring all other costs other than wage costs, how much profit can your crew generate in total in one day working on a 10 hectare site?

Question 6. Table 4 shows Land Expectation Values for three different land management options. In the example below, timber is managed on a 45 year rotation, timber and carbon on an extended 65 year rotation, and cattle revenues are annual, where the current value of the returns do not differ.

Table 4. LEV values for different land management options

Discount rate	timber	timber and carbon	cattle
4%	\$2,066	\$2,101	\$500
8%	\$323	\$199	\$250
10%	\$139	\$66	\$200

a) Which option would be ranked highest evaluated at 4%?

b) Why might the relative rankings change as discount rates change?

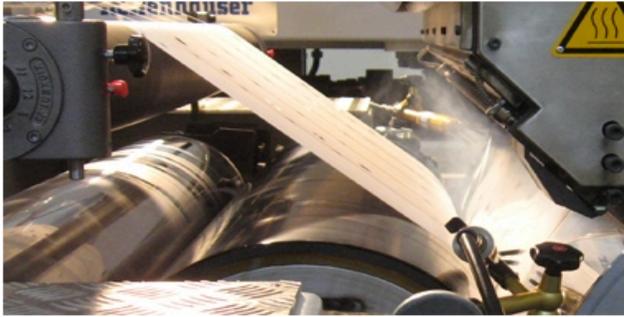
Part III. Essay Question (40 points each)

Please select and answer **two** of the five questions.

Question 1. Read the following article. What is the impact of the duty on in the export market for market pulp? Are Chinese consumers of pulp better or worse off? Please show how.

FORESTRY

Vancouver's Fortress Paper 'very disappointed' with China's pulp duty decision



Fortress Paper

By Tyler Orton

Fri Apr 4, 2014 9:39am PST

The Chinese government is sticking by its previous decision to impose a 13% duty on cellulose pulp coming from Canada, the U.S. and [Brazil](#) — a move Vancouver-based Fortress Paper (TSE:FTP) says will hurt business.

China's Ministry of Commerce (MOFCOM) made the final determination April 3 after it had already announced an interim duty of 13% on dissolving pulp imports.

Fortress Paper said in a release it's "very disappointed" with the outcome and is evaluating alternatives for its Global Cellulose Mill in Lebel-sur-Quevillon,

Quebec, as the final duty for any unnamed current or future pulp producers would be 23.7%. The government previously set the duty at 50.9%.

"We're very challenged and pained by the decision," Fortress Paper CEO Chadwick Wasilenkoff told Business In Vancouver.

"It's been very obvious and apparent that there's been preferential treatment given to those mills that have Chinese ownership."

Although pulp duties for the company's mill in Thurso, Quebec, will remain at 13%,

Wasilenkoff said the 23.7% duty at the Global Cellulose Mill makes that particular operation economically unviable.

He added an agreement with the previous owner prevents Fortress Paper from producing paper pulp for eight more years, so the company is exploring options such as using the site for energy production or a pellet plant.

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UBC researchers genetically engineer trees for easier biofuel, pulp processing

Earnings jump for western Canadian forestry companies

Tags: Imports, Chinese government, World Trade Organization

Question 2. The Forest Practices Board has identified an issue in regards to current harvesting and the midterm timber supply described below. Please explain the links between the two and what difference (if any) might exist between an individual licensee’s objectives in a TSA and the government’s objectives (in regards to timber supply).

If a pine beetle tree falls in the forest

Posted On 28 Mar 2014 Prince George Free Press

When the Mid-Term Timber Supply Review came out a couple of years ago, it contained some dire warnings about timber supply in mountain pine beetle hit areas.

“In the Prince George Timber Supply Area, the pre-beetle allowable annual cut was 9.3 million cubic metres. The current AAC is 12.5 million cubic metres and the mid-term timber supply projection is 6.4 million cubic metres per year,” it stated.

That would see employment in the forest sector go from 13,371 before the beetle epidemic to 8,763. It stated that taking measures, such as allowing harvesting in old-growth forests could mitigate, somewhat, the job losses. The province struck a committee, headed up by Nechako Lakes MLA John Rustad, to examine ways to mitigate the job loss. Suggestions have been put forward, such as eliminating viewscapes, logging old-growth forests, and allowing licensees to harvest marginal pine stands with the bonus they could “access the entire timber harvest land base.”

The Forest Practices Board, however, this week threw another unforeseen wrinkle in the looming decrease in allowable annual cuts in mountain pine beetle areas.

A report on the forest industry’s harvesting of beetle-killed timber confirms that industry has been meeting government’s expectations for concentrating harvesting on dead pine trees, but says the harvest of other kinds of trees is increasing more than expected in some areas of the province.

“The switch from harvesting dead pine trees to live non-pine trees means the mid-term timber supply is starting to be cut now and not five to 10 years in the future,” said board chair Tim Ryan. “The issue, simply put, is that the more live trees that are harvested now, the lower the sustainable harvest level will be after the salvage program is finished. We believe the chief forester needs to respond to the rapidly changing situation with timely updates to the allowable annual cuts.”

The majority of the pine trees harvested last year were dead, but over the last four years, the total amount of pine in the harvest has been steadily decreasing and was under 60 per cent of the harvest last year, he said.

The Forest Practices Board is encouraging government to re-evaluate decisions about what should be harvested in those areas, taking into account the current dynamics of salvage harvesting.

It’s sage advice and advice that should be heeded. The only question is whether our LNG-focused government will pay attention to what’s happening in the forests.

Question 3. The following excerpt is taken from BC Hydro's 2013 Resource Options update. Please explain the linkages between the US housing market and its impact on the biomass market and implications for producing bioenergy in BC.

In 2008, the collapse of the US housing market resulted in a substantial drop in lumber selling-prices. In most instances, prices were below the cost of production. North American log processing mills reacted by curtailing production. Accomplished through a reduced number of operating shifts, increased down-time, or by permanent or indefinite mill closure. A significant consequence has been the reduction in the supply of mill waste by-products. The price of wood-chips rose considerably, and the price for sawdust, shavings and bark, (which in 2001 could be had for next to nothing) skyrocketed. Manufacturing plants that developed between 1998 and 2006 to utilize the large supply of sawmill residues were confronted with both a large increase in cost and reduction in supply of their raw materials. Other fibre supply sources needed to be explored. Roadside residues and whole-log grinding of dead pine stands were considered. To-date, the salvage of roadside residues in logging operations closest to manufacturing centers has proven to be economical – if supplemented with other cheaper sources of residual fibre. Grinding or chipping logs at any significant distance from a manufacturing plant is not currently economical for industries other than pulp and paper. To mitigate the higher cost of salvaging biomass from the forest, the existing residual industry has aggressively sought to develop long-term residual-wood supply agreements with BC sawmills. As a result, there is very little in the way of sawmill or veneer plant residues remaining in the BC Interior that have not already been allocated to a consumer.

Question 4. Please read the following article and explain the economic analysis underlying Dr. Fearnside's contention.



Pasture meets gallery forest in the Brazilian Amazon. Photo by: Rhett A. Butler.

How much is a forest really worth? And what is the cost of forest degradation? These values are difficult to estimate, but according to Dr. Phillip Fearnside, we need to do a better job. For nearly forty years, Fearnside has lived in Amazonia doing ecological research, looking at the value of forests in terms of environmental or [ecosystem services](#) such as [carbon storage](#), [water cycling](#), and [biodiversity](#) preservation. Fearnside then works to convert these services into a basis for sustainable development for rural populations.

"The idea of 'environmental services' was certainly radical and innovative when this started out, but now it is a household word. Nevertheless, there is a long way to go before this substitutes for forest destruction here," Fearnside told mongabay.com. Fearnside also feels we need to improve our ability to estimate forest degradation. Degradation, or the gradual destruction of forests caused by [edge effects](#), climate change, and infrastructure projects has received less attention from scientific and environmental groups than outright [deforestation](#).

"The ability to estimate the effect of specific infrastructure projects and policy decisions is essential," Fearnside said. "Most of what has been done on deforestation deals with region-wide trends, but it is the effect of specific projects that counts most." To this end Fearnside says one area that has received too much attention and funding is restoring degraded lands over avoiding deforestation in the first place.

"The advantage of recuperating degraded areas is that everyone is in favor of it, whereas avoiding deforestation must buck powerful economic interests... The financial cost of recuperating a hectare of degraded land is much higher than the cost of avoiding the loss of a hectare of native forest, and the benefit in terms of biodiversity, water and carbon is much less."

Fearnside has authored over 490 professional publications focused on problems of environment and development. In 2006 he was identified by Thompson-ISI as the world's second most-cited scientist on the subject of global warming. In 2012 he was identified as the world's seventh most-cited scientist in the area of sustainable development.

Read more at <http://news.mongabay.com/2014/0327-forestinnovation-kimbrough-fearnside.html#LLuvZrpWRsSyFStB.99>

Question 5. Please explain exactly how Kronospan is being negatively impacted by the UK's energy policies and comment on whether or not this outcome is socially optimal.

Kronospan jobs threat: Woodchip firm's fears over rising wood prices

Daily Post, by Owen Hughes April 9, 2014.

Wood panel firm [Kronospan](#) – which employs 600 workers – has fired a warning over the future of its Chirk plant with fears that biomass plants are fuelling a hike in UK timber prices.

The company says the UK has seen a 10% rise in prices in the first quarter of 2014 and that they have doubled in 10 years. This has already halted exports as the plant struggles to compete with cheaper competitors in Central and Eastern Europe. Now there is “concern” that the UK market could be hit by an influx of cheaper imports that could damage Kronospan’s domestic market. The firm is asking for Government action over subsidies to biomass which it blames for a surge in demand for wood and the rise in prices. Chris Emery, timber procurement executive at Kronospan, said: “This is a big concern, certainly at managerial level there is real concern over this. “We have seen a 10% increase in the price of round wood since the start of the year and the price has doubled over 10 years. The recent rises have thrown us because it had been a mild winter and we did not expect the biomass demand to rise so strongly. “It is the small scale operations that are a concern because it is hard to keep track on them. “We need to speak out about this now and Government needs to take action, we need action to keep it viable.” He said a combination of biomass and the growing house building market is now causing the problem. He added: “This (price rise) is because of the increase in demand for timber for use in biomass because of the subsidies that have been on offer. “This has been around over a number of years but it is now that we are seeing sharp increases in prices because of the upturn in the housing market. “We have had to be more efficient and at present we can still compete on price in the Uk market but over the last two to three years our export market has gone because we could not compete. This had been 10% of our business. “We are still holding up in the Uk but there are concerns over imports, especially from Eastern Europe where costs are lower. It would only take a change in the exchange rate to see an influx of imports to the UK. That would have a major impact on us.”Kronospan believe that biomass subsidies should be for end-of-life wood, wood that can no longer be used for anything else. The firm are themselves investing in a [biomass facility](#) for recycled wood fibre rejected from the manufacturing process, bark stripped from logs, and dust and fibre not used in the manufacturing process. The Wood Panel Industries Federation has consistently stated that subsidy regimes biomass energy are distorting wood markets and should be removed Current subsidies have led to an unfair advantage for large-scale wood fuelled power generators and potentially a threat to the wood panel industry’s UK operations by driving up costs, according to the WPIF. Wood panels, a vital component in the construction industry and in furniture manufacture, are produced from virgin and reclaimed wood – the same materials which biomass energy plants are being incentivised to burn by Government subsidies. Clwyd South MP Susan Elan Jones MP has called for the Wales Office to act directly to help Kronospan. She said: “Kronospan is massively important. It has a thriving apprenticeship programme supported by the Welsh Government, teaching young people real-life employment skills. "Kronospan and I are concerned by various incentives in the Government’s renewables obligations and the new Energy Act 2013 to purchase wood for energy generation.” A department for Energy and Climate Change spokesman said: “We take this matter seriously and our analysis has shown there is enough wood available to cost effectively meet the needs of both the wood panel plants and for the biomass projects we expect to come forward for support.”

<http://www.dailypost.co.uk/business/business-news/kronospan-jobs-threat-woodchip-firms-6937553>

Mahsa’s Bonus Question: Who is the writer of introduction to forestry economics (FRST 318 textbook):

1. Peter Jackson
2. Peter Pearse
3. Peter Capaldi
4. Peter Schiff