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1. Assume land in Wyoming is fixed at 100,000 square miles ($Q_s = 100{,}000$). Additionally assume that the demand for land in Wyoming is characterized with the following equation:
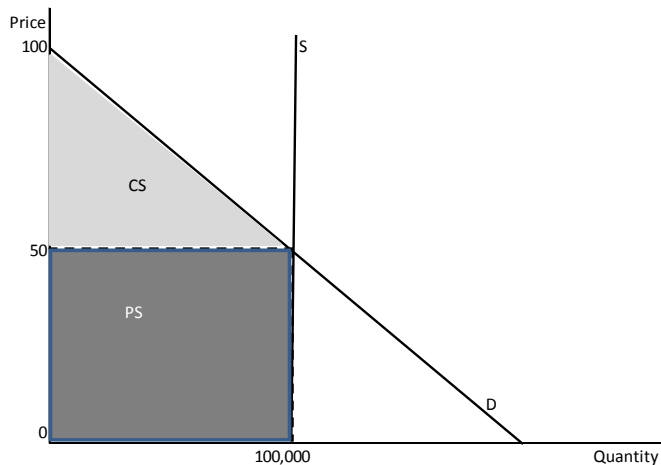
$$P = 100 - \frac{Q_d}{2{,}000} \tag{1}$$

where P is the price of land per square mile and Q_d is the quantity of land demanded (in square miles).

   a. Compute the equilibrium price for land in Wyoming?

$$P = 100 - \frac{Q}{2{,}000} = 100 - \frac{100{,}000}{2{,}000} = 100 - 50 = \$50$$

   b. Compute the consumer surplus for land in Wyoming.

$$CS = 0.5 * 100{,}000 * 50 = 2{,}500{,}000$$

   c. Compute the producer surplus for land in Wyoming.

$$PS = 100{,}000 * 50 = 5{,}000{,}000$$

Now assume that a sales tax of $5 per square mile is implemented on all land in Wyoming.

   d. True, false, or uncertain. Justify your conclusion. Social welfare is decreased with the new tax.

False. As shown below, consumer surplus is unchanged while producer surplus is transferred to taxes. Since there is no deadweight loss, social welfare is unchanged.
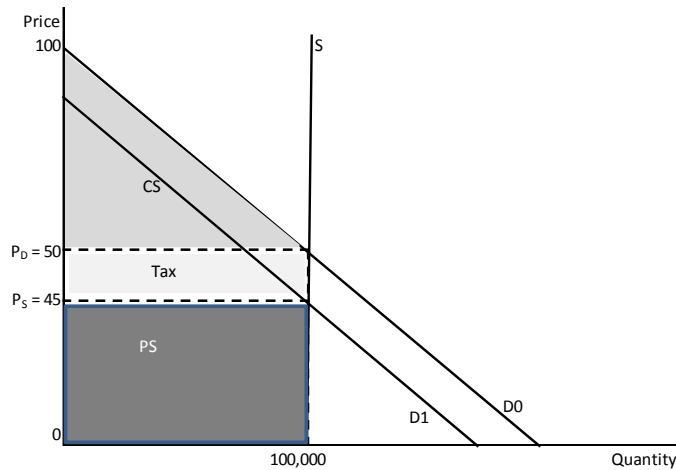
Now assume the sales tax is removed and that supply is not fixed but rather is characterized with the supply curve below in equation (2). Also, the demand equation from above still applies. Also, assume that a law is passed that limits the price of land to $40 per square mile.

$$P = \frac{Q_S}{2,000} \qquad (2)$$

e. Is this an effective price ceiling? Explain.

Yes, this is an effective price ceiling since the price of $40 is set below the equilibrium price of $50.

f. Is consumer surplus higher, lower, or unchanged under the effective price ceiling? Justify your answer.

See the graphic below. The total impact on consumer surplus is somewhat ambiguous. First, surplus is increased due to the lower price. Second, surplus is reduced due to the deadweight loss component. The new consumer surplus can be calculated as the area of a triangle and a rectangle. $CS = (0.5 * 40 * 80k) + (20 * 80k) = 1,600,000 + 1,600,000 = 3,200,000$. Therefore, consumer surplus is increased.

However, you could argue that the rectangular gains in consumer surplus will be eaten away through queuing, making the effective price (after accounting for the queuing) to be $60. This would result in a reduction to consumer surplus.

g. Is producer surplus higher, lower, or unchanged under the effective price ceiling? Justify your answer.

See graphic below. Producer surplus is lower. The new producer surplus is 1,600,000.

h. Does deadweight loss increase under the effective price ceiling? Justify your answer.

Deadweight loss is now 200,000 [=0.5*20*20k], which is an increase from zero as previously. See graphic below.
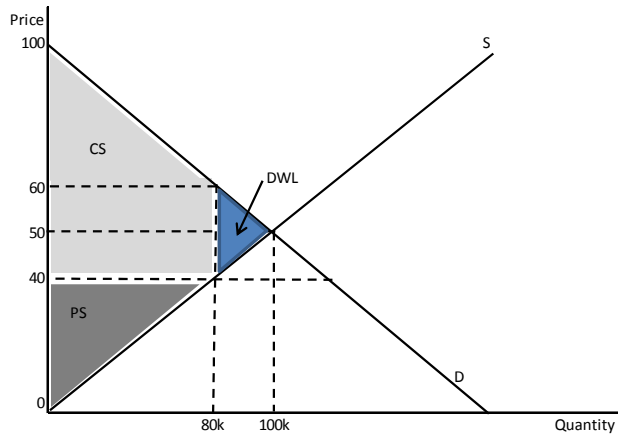
Now assume the Wyoming legislature signs a bill that grants the state government the property rights to all land in Wyoming. This surprising new legislation provides the state with the ability to act as a monopolist in selling all land in Wyoming. Assume demand is characterized with equation (1) and that the marginal cost for the monopolist is according to equation (2).

i. Compare the equilibrium quantity and price for land in Wyoming under Monopoly rule as compared to the perfectly competitive market. Show how land prices and quantity are likely to change.

Prices are expected to increase and quantity is expected to decrease under monopoly rule.

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