

INSTITUTO SUPERIOR DE AGRONOMIA

Test of Applied Operations Research - 5 June 2014/15

PART A

Number:

Name:

1. Consider a ponderosa pine forest that could be managed either as multiple-use area for recreation and timber or as a wilderness that would allow only for recreational activities. The forest consists of 1600 ha of high-site (*i.e.*, high-productivity) land and 2400 ha of low-site land. The expected outputs from the forest, by site and management option, are given in the following table. Find the annual management plan that would maximize the amount of recreation (in visitor-days per year, vd/y) while producing at least $1400\text{m}^3/\text{y}$ of timber and keeping sediments less than or equal to $200\text{ m}^3/\text{y}$.

Table 1: Outputs per hectare, by site and management options.

Output	High-site land		Low-site land	
	Wilderness	Multiple use	Wilderness	Multiple use
Timber ($\text{m}^3/\text{ha}/\text{y}$)		3.5		1.2
Sediment ($\text{m}^3/\text{ha}/\text{y}$)	0.06	0.12	0.03	0.06
Recreation (vd/ha/y)	1	0.25	0.6	0.15

- a) Formulate the problem as a linear program.
- b) Solve the problem using the Excel Solver. What is the optimal solution to the problem?
- c) Which constraints are binding? How do you interpret each binding constraint?
- d) What is the range of optimality for the objective function coefficient for each variable? How do you interpret this range?
- e) What is the shadow price for each constraint? How do you interpret this value?
- f) What is the range of feasibility for the shadow price of each constraint? How do you interpret this range?