

**Professional Foresters Registration Examination, October 4 2024**

**PART I**

**APPLICANTS, PLEASE READ THESE INSTRUCTIONS CAREFULLY.**

**You MAY complete PART I by:**

**ANSWERING any Three (3) of Questions I through V.**

**Question I Short Answer  
Question II - Forest Ecology  
Question III - Forest Economics  
Question IV- Silviculture  
Question V - Forest Protection**

Professional Foresters Registration  
1416 9th Street, Room 1506-16  
Sacramento, CA 95814

## ACRONYMS AND ABBREVIATIONS USED IN THIS EXAMINATION

The following Acronyms and /or Abbreviations **may be used** in this examination. Technical abbreviations that should be known by a forester are NOT included here (e.g., DBH, MAI, MBF). You may remove this page for reference throughout this examination. **It need not be returned.**

<u>Acronym or Abbreviation</u>	<u>Full Text</u>
BLM	Bureau of Land Management, USDI
BOF	California State Board of Forestry and Fire Protection
CA	California
CCR	California Code of Regulations
CAL FIRE	California Dept. of Forestry and Fire Protection
CDF&W	California Department of Fish and Wildlife
FPR	California Forest Practice Rules
PRC	California Public Resources Code
RPF	California Registered Professional Forester
THP	California Timber Harvest Plan
TPZ	California Timber Production Zone
USFS	United States Forest Service, USDA

Applicant #: \_\_\_\_\_

Question #   I  

**Answer on these pages, tear from the exam and submit with the answer packet if you chose to answer Question I of this examination.**

**October 2024 RPF EXAMINATION**

**3%** 1. When an alien or exotic species can establish, grow, reproduce, and maintain itself in an area where it did not originally grow, it is said to be:

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**4%** 2. According to the FPRs, what are the intent and major variables of the Variable Retention method?

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**3%** 3. Three (3) forestry-related approaches to carbon offset projects have evolved. List and briefly describe these markets.

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**3%** 4. According to the FPRs, what is the intent and process of the Seed Tree regeneration method?

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**3%** 5. As used in forest management, describe a Stumpage Sale .

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Applicant #: \_\_\_\_\_

Question #   I  

**Answer on these pages, tear from the exam and submit with the answer packet if you chose to answer Question I of this examination.**

**4%** 6. Nitrogen is thought to be the most important nutrient element limiting plant growth in the commercial forests of California. Explain how some shrubs can improve the amount of available soil nitrogen.

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**3%** 7. As used in forest habitat, describe Mast.

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**3%** 8. The difference between the greater volume actually sawn over the lesser estimated log scale volume is called?

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**3%** 9. What is a Species?

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**3%** 10. As used in forest policy, what is Long Term Sustained Yield?

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**3%** 11. As used in forest engineering, what is daylighting?

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**3%** 12. As used in forest carbon projects, what is Carbon Accounting?

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Applicant #: \_\_\_\_\_

Question #   I  

**Answer on these pages, tear from the exam and submit with the answer packet if you chose to answer Question I of this examination.**

**4%** 13. What is a Metadata? List three (3) examples of metadata.

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**3%** 14. According to the FPRs, what are the intent and process of the Commercial Thinning intermediate treatment?

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**3%** 15. Describe a CUTTING CONTRACT?

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**3%** 16. List and briefly describe three (3) sawing techniques used in modern log sawmills.

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**3%** 17. Define BI or Burning Index as it is used in Fire management.

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**3%** 18. *Armillaria mellea* (oak root rot) is endemic in California. What are three (3) ways by which you can decrease the prevalence of this problem for conifers in a managed forest setting?

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Applicant #: \_\_\_\_\_

Question #   I  

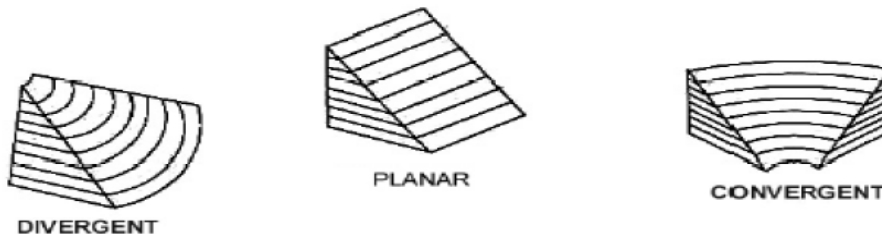
**Answer on these pages, tear from the exam and submit with the answer packet if you chose to answer Question I of this examination.**

3% 19. Define the term Agroforestry.

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3% 20. According to the Forest Practice Rules (technical addendum # 5), which of these three major slope forms is most stable: Planar, Divergent or Convergent?



**SLOPE FORMS**

3% 21. In performing a Stocking Survey for a plantation area, you lay out a uniform grid as prescribed and sample 40 plots. One plot fell in an unregenerated landing, one on top of a large boulder. What would be the minimum number of stocked plots needed to find the area in a stocked status, according to the CA forest practice rules? Show your work.

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3% 22. What California law requires forest practice regulations to address archeological resources? \_\_\_\_\_

3% 23. How do the FPRs define a Critical Dip?

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Applicant #: \_\_\_\_\_

Question #   I  

**Answer on these pages, tear from the exam and submit with the answer packet if you chose to answer Question I of this examination.**

**3%** 24. A rectangular piece of land measures 40 chains by 78 chains. How many acres (round to acres) are in this piece of property? Please show your work including the units of measure.

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**3%** 25. Give the scientific names of three (3) genera of bark beetles common to California conifers.

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**4%** 26. In 2012, the Timber Regulation and Forest Restoration Fund was created. Explain how this Fund is fiscally supported and give two (2) uses for the dollars in this fund.

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**3%** 27. As used in Mensuration, what is Stem Analysis?

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**3%** 28. In Forest Economics, what is an Equilibrium State?

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**3%** 29. What is a genetically improved tree?

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Applicant #: \_\_\_\_\_

Question #   I   \_\_\_\_\_

**Answer on these pages, tear from the exam and submit with the answer packet if you chose to answer Question I of this examination.**

**3%**    30. As defined in the CA FPRs, what is a Deactivated Road?

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**3%**    31. Define what is meant by the ecological term, obligate species.

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**3%**    32. Define integrated pest management.

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**End of Short Answer Question #1**



## QUESTION II-FOREST ECOLOGY

### OBJECTIVE:

To demonstrate your knowledge of some of the ecological conditions and processes within the forest soil.

### QUESTIONS:

**24%** 1. Root diseases can be caused by both biotic and abiotic factors. They are often thought of as detrimental features in the management of forest stands. However, that assumption may not always be correct. Discuss three (3) **beneficial** aspects root diseases may have in the ecology of a forest.

**20%** 2. Describe damping-off and what role it plays in forest regeneration. Include in your discussion forest and nursery environments as they relate to damping-off, both host and pest species involved, and the biology of the pest.

**15%** 3. You can often identify fungal-caused root diseases by observing the infected tree's symptoms and signs.

- A. Give the common or scientific names of three (3) fungal root diseases found in western US conifers.
- B. What are the differences between symptoms and signs of root disease?

**26%** 4. For the 3 diseases you listed in question #3, select two (2) and briefly discuss the following:

(10%) 4.a. For **each** of the two (2) diseases, what specie(s) of trees are most commonly attacked?

(16%) 4.b. Give two (2) examples of symptoms **and** two (2) examples of signs for each of the two (2) common root diseases found on western conifer species that you selected in Part a of this question. Note, a total of eight responses are needed.

**15%** 5. Define mycorrhiza and discuss their function and significance relating to forest trees and artificially grown nursery stock. Be specific.

**END OF QUESTION**

## QUESTION III-FOREST ECONOMICS

### OBJECTIVE

To demonstrate your understanding of how to evaluate the economic viability of stand cultural practices.

### SITUATION

As a new member of the management team in a consulting firm, you have been tasked to evaluate the economic viability of stand level cultural practices proposed by the firm's field foresters. Your firm manages highly productive private commercial timberland on the West side of California Cascade and Sierra Nevada mountains.

### Questions:

**25%** 1. A RPF submits a request to pre-commercially thin eight-year-old plantations. Describe in detail the process you will use to evaluate this proposal. Be sure to include all the data you will require or develop, and the decision criteria you will utilize.

**25%** 2. Your firm has a limited budget for proposed stand cultural practices. The expected cost of all proposals submitted by field RPFs greatly exceeds this budget. How will you decide which proposals you will recommend funding?

**25%** 3. One of the projects submitted proposes to increase stand fire resilience by masticating surface and ladder fuels, then reducing those fuels by prescribed fire. The firm's clients like the concept but have asked about its economic viability. How will you evaluate the economic viability of that project? Describe in detail the process you will use to evaluate this proposal. Be sure to include all the data you will require or develop, and the decision criteria you will utilize.

**25%** 4. The economic analysis of the Fire and Fire Surrogate study in the central Sierra produced the following data over 20 years of the study. Treatments were control, prescribed fire only, mechanical treatment only, and combination of mechanical and prescribed fire.

Treatment costs and revenues:

Fire had a net cost (US\$163 ha<sup>-1</sup> year<sup>-1</sup> with the cost of prescribed fires declining with each subsequent entry. Mech + Fire was close to break even in terms of cost, generating a small net revenue of US

\$13 ha<sup>-1</sup> year<sup>-1</sup>. Mech generated revenues of US \$337 ha<sup>-1</sup> year<sup>-1</sup>.

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Question #4 – continued

The Fire and Fuels Extension (FFE) to the **Forest Vegetation Simulator (FVS)** simulator was used to predict the probability of tree torching when encroaching severe wildland crown fire occurs. The P-torch values predict the percentage of overstory trees scorched by wildfire.

The modeled P-torch was equal to 0 (that meaning trees survived) on only 12.7% of Control, 39.2% of Mech, 55.9% of Fire, and 87.0% of Mech + Fire units. Plots from all three active treatments had a significantly higher probability of having zero P-torch than Control.

Each percentage point in P-torch reduction accomplished by Fire over the study period cost US \$11 ha<sup>-1</sup>. Mech generated a revenue of US \$16 ha<sup>-1</sup> for each percentage point reduction, and Mech + Fire broke even at less than US \$1 revenue generated.

Protecting 1 m<sup>2</sup> of basal area with Fire came at a cost of US \$67 ha<sup>-1</sup> , Mech generated a revenue of US \$156 ha<sup>-1</sup> , and Mech + Fire generated US \$7 ha<sup>-1</sup>."

How might you use this type of information to evaluate alternative Fire Resilience treatments?

**END OF QUESTION**

## QUESTION IV FOREST SILVICULTURE

### OBJECTIVE:

To demonstrate understanding of silviculture principles and their application to managed stands.

### QUESTIONS:

- 10%** 1. As used in silviculture, what is stand composition?
- 10%** 2. As used in silviculture, what is stand structure?
- 10%** 3. As used in silviculture, what is stand function (not just how the trees grow)?
- 30%** 4. A stand was established on the site of a large mixed conifer stand replacement wildfire followed by savage harvest. Previous stand treatments include mechanical site prep and pile burning, preemergent herbicide spray, and planting 200 tpa PP with 95% survival.
- (10%) 4.a. Describe the structure, composition and function of this site II commercial plantation of pure ponderosa pine at age ~ 20.
- (10%) 4.b. Explain and justify the effect of early stand treatments on the age = 20 stand.
- (10%) 4.c. Explain and justify what might have been done differently in the past and possible future treatments, if any, you prescribe through the next commercial harvest. Your goal is to maximize board foot volume recovery while increasing stand fire resilience.
- 10%** 5. What is stand density management? What two (2) specific control points are used in stand density management?
- 30%** 6. Review the density management diagram for Douglas fir shown at the end of this question. The diagram is extracted from: Drew, T. J. and J.W. Flewelling. 1979. Stand density management: an alternative approach and its application to Douglas-fir plantations. Forest Science 25:518-532.
- (5%) 6. a. If a plantation has 200 well established trees per acre, what QMD and average height will the stand have when the canopy closes?
- (5%) 6. b. Assume a stand is low thinned when the canopy closes. What should the residual TPA be of that thinning if you wish the stand QMD to be about 14" when density reaches the zone of imminent competition induced mortality?
- (5%) 6. c. How many well-established seedlings are needed per acre to begin a stand which will have a QMD of 16 inches dbh when it reaches the zone of imminent competition mortality?
- (5%) 6. d. If a stand naturally regenerated from seed fall has 400 trees per acre, what size will the regeneration be when the stand reaches ~ .15 relative density?
- (10%) 6.e. Assume a planted stand with ~300 TPA surviving trees. Draw a line on the density diagram depicting a precommercial thinning, a commercial thinning (12" dbh is minimum merchantable size) to 120 tpa, and final harvest when trees contain ~ 100 ft<sup>3</sup> each. Explain and justify the line you drew.

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Applicant #: \_\_\_\_\_

Question # IV

Answer on this page, tear from the exam and submit with the answer packet if you chose to answer Question IV of this examination.

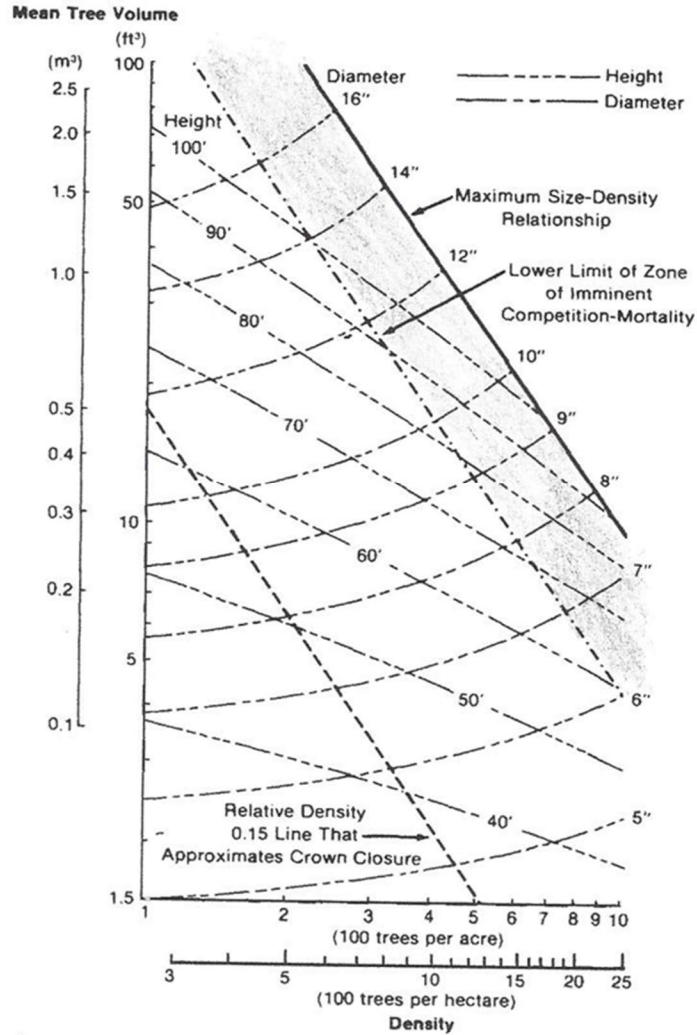


Figure 2. Stand management diagram for Douglas-fir with estimates of diameter and height.

End of Question and Answer

## QUESTION V- FOREST PROTECTION

### OBJECTIVE:

Demonstrate your understanding of how protecting forests from catastrophic disturbance affects forest carbon stocks and sequestration.

### SITUATION:

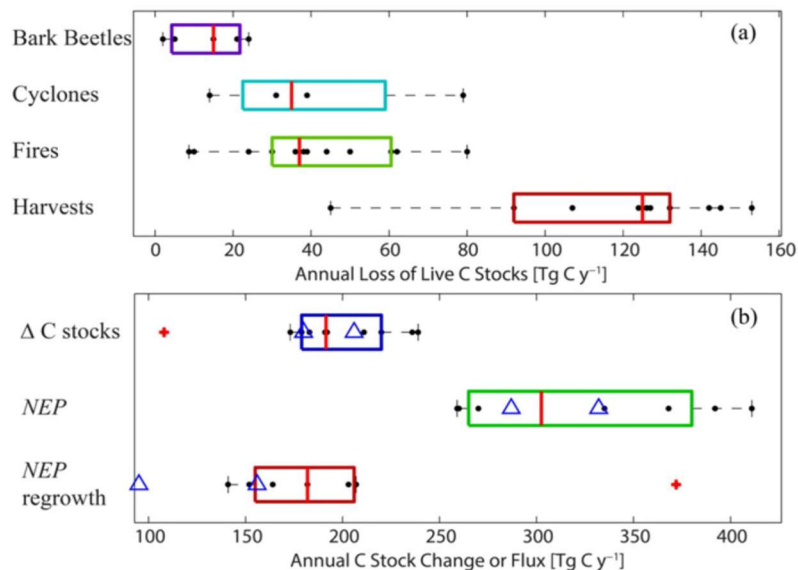
Disturbances (natural, anthropogenic and mixtures) are a major determinant of forest carbon stocks and sequestration. Foresters and policymakers look to forests for climate protection and mitigation. Due to increasing concern about changes in disturbance intensity and frequency, there is a need for understanding the role of disturbances and recovery in governing forest carbon cycle dynamics, and the likely future of managed forests as sources and sinks for atmospheric carbon.

### QUESTIONS:

**10%** 1. List and rank the three (3) disturbance types (natural or anthropogenic) which average the most extensive effects in terms of area affected and carbon impacts in California in the three decades between 1989 and 2019. How has that changed since 2020? How are these disturbance effects interrelated?

**For questions # 2 through 5, consider the following data for the contiguous 48 states in USA (not just California).**

$Tg\ Cy^{-1} = \text{Teragrams of Carbon per year, A Teragram} = 10^{12} \text{ grams}$



*Box plots of multiple estimates for (a) mean annual disturbance-induced fluxes over the last three decades in the conterminous US, and (b) the change in carbon stocks, total net ecosystem productivity (NEP) and NEP due only to disturbance and regrowth processes (NEP regrowth). Black dots show values from individual studies, red pluses indicate outliers, and blue triangles indicate process model estimates.*

**Vertical red lines are means; NEP includes NEP from regrowth**

**5%** 2. Which one (1) of these disturbance regimes averages the most extensive effects in terms of carbon impacts in the contiguous 48 states of USA (not just California) over the decades 1989-2019

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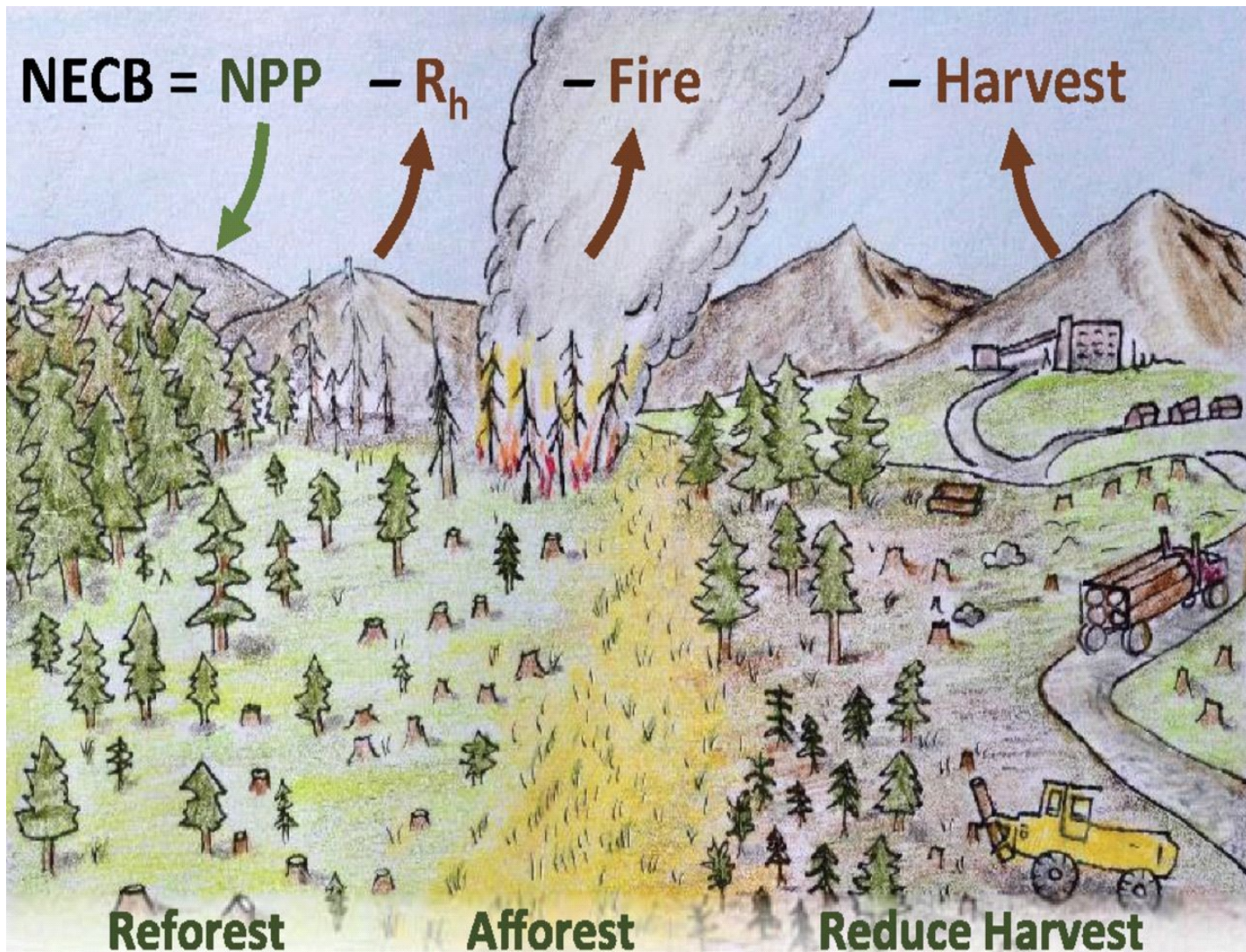
**10%** 3. Is the net flux (change) in forest carbon stocks due to these disturbance – recovery regimes in the contiguous 48 states of USA over the decades 1989-2019 positive or negative? Why?

**5%** 4. What is the approximate annual loss in forest carbon stocks due to these four disturbance – recovery regimes in the contiguous 48 states of USA over the past three decades?

**5%** 5. What is the approximate annual total growth in forest carbon due to these disturbance – recovery regimes in the contiguous 48 states of USA over the decades 1989-2019?

**15%** 6. Discuss how disturbance regimes influence forest carbon storage.

*NECB is productivity (NPP) minus  $R_h$  (Heterotrophic respiration) and losses from fire and harvest (red arrows). Harvest emissions include those associated with wood products and bioenergy.*



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- 10%** 7. Discuss the trend in forest disturbance events,
- Are contiguous 48 states of USA forest disturbance events stable, increasing or decreasing in both frequency and severity?
  - How do forest disturbance events in California compare in both frequency and severity with the rest of the contiguous 48 states of USA and global forests?
- 20%** 8. Forest carbon storage is one of the most efficient and effective mechanisms currently mitigating anthropogenic carbon emissions. Discuss how climate change may enhance or degrade this opportunity.
- 20%** 9. Discuss the positive and negative ways that forest management affects carbon sequestration and stocks in California forests.

**END of QUESTION**



**Professional Foresters Registration Examination October 2024**

**Part II**

**Applicant Must Answer Three (3) of the  
Remaining Five Essay Questions in Part II**

Question VI-Forest Mensuration  
Question VII- Forest Administration  
Question VIII- Engineering  
Question IX- Forest Policy  
Question X-Forest Management

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Registration 1416 9th Street,  
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## Question VI-Forest Mensuration

### OBJECTIVE

To determine your understanding of various methods of predicting forest growth.

### SITUATION

Your employer has requested your advice about obtaining forest growth information necessary for preparing a timber management plan. He is interested in putting the entire property under management for long-term timber productivity.

The subject property is a contiguous block of 10,000 acres of mixed conifer timber on medium or better site. Most of the property contains timber of average uniformity, all-aged, medium stocking and with a good distribution of age classes. Some areas, however, contain even-aged stands of young sawtimber. The block is adjacent to somewhat similar properties that have been managed for sustained yield for 20 years or more. The landowner is concerned about the cost of the project but is willing to spend enough money and allow enough time to develop the necessary information.

### QUESTIONS

**Briefly describe** each of the traditional methods of obtaining growth data listed below **and discuss the appropriateness and limitations** of each to meet the landowner's stated objective for the described forest condition:

**5%** 1. General Observation

**20%** 2. Even-aged Yield Tables

**25%** 3. Stand Table Projection

**25%** 4. Permanent Growth Plots or Continuous Forest Inventory

**25%** 5. Computer Growth models

**END OF QUESTION**

## QUESTION VII- FOREST ADMINISTRATION

### OBJECTIVE:

To demonstrate your understanding of the environmental documentation required of Registered Professional Foresters by the CA Forest Practice Rules when preparing THP's.

### QUESTIONS

**15%** 1. The **Forest Practice Rules** and Regulations, Section 897(b)(1), states: "the goal of forest management on a specific ownership shall be the production or maintenance of forests which are healthy and naturally diverse, with a mixture of trees and understory plants, in which trees are grown primarily for the production of high quality timber products".

The CCR [897(b)(1)] further lists five broad objectives that the CALFIRE Director can use as a basis to determine whether a THP conforms to the intent of the Forest Practice Act.

State **THREE (3)** of those objectives.

**20%** 2. In general terms, briefly discuss what the Forest Practice Rules require of the RPF with regard to probable adverse environmental effects associated with a THP being prepared?

**20%** 3. Briefly discuss the specific information needed to evaluate, in the THP, **One (1)** of the following THP categories:

- a. Harvesting practices & erosion control
- b. Watercourse and lakes
- c. Wildlife

**45%** 4. Using the following scenario, develop **ONE (1) SHORT RESPONSE** to **EACH** of these **Eight (8)** categories of potential cumulative impacts as part of the assessment process for a THP you are preparing. Consider the information given in the scenario, state any assumptions, conclusions and briefly support your conclusions. The eight categories are: Watershed, Soil Productivity, Biological, Recreation, Visual & Aesthetics, Traffic, Cultural, Other (from Technical Rule Addendum #2)

### SCENARIO For Question Part #4

The area covers 120 acres of TPZ forestland supporting second growth mid-site commercial conifers and hardwoods. The landowner must pay off medical debts of \$250,000 and \$300,000 grandchildren educational expenses from revenue generated through timber harvest.

A Class I watercourse flows down the center of the property and two small tributaries flow to the main stem through the property. A downstream neighbor has used one of these tributaries for

over 15 years for domestic water. The other tributary carries noticeable sediment after light rains from eroded material on an old rotational slump activated by historic railroad logging.

You have found an old railroad grade that would serve as an ideal truck road to the harvest unit you are proposing. The existing wooden trestle crossing one of the tributary watercourses must be replaced with a rail car bridge to facilitate truck traffic into the watershed.

A popular swimming hole is on the main stem of the river within the property.

Neighbors have sighted a bald eagle foraging along this watercourse. The landowner is unaware of any nest sites in the area.

The local elementary school yard is adjacent to the only haul route for timber products from this property to nearby mills.

**Assume:** Stand age is 60 years; MAI 600 bd ft/ac/yr.; stumpage value \$400/mbf

**End of Question**

## QUESTION XIII-FOREST ENGINEERING

**Objective:** Demonstrate how to use Partial Harvest in Watercourse and Lake Protection Zones Using Low Ground Pressure Equipment to develop Fire Resilient, Ecologically Diverse Stands and Associated Ecosystem Services

**Situation:** Severe fire seasons in California have prompted land managers and resource professionals to take a closer look at management practices that may reduce the hazard for large, severe, destructive wildfire.

As a RPF, you are developing a THP for commercial forestland. The stand in question is situated mid-slope, class I site, ~30% side slope, West side of the Sierra Nevada. A Class I stream course traverses the THP area. The standard width WLPZ contains dense multistory canopy, significant LWD and occasional unstable banks.

**Questions:**

**20%** 1. Why have riparian zones become of increasing interest in the quest to restore fire resilience to commercial forests in California?

**80%** 2. ( 20% for each concern selected.) Discuss four (4) of the following major concerns of using heavy equipment in the riparian zone. For each concern identify the specific resources at risk if heavy equipment operates in a WLPZ. Discuss how the use of heavy equipment might create adverse impacts. Indicate which of the 18 (eighteen) listed BMPs could be implemented to mitigate the concerns. Be sure to explain how the BMP would function to mitigate concerns when operating in or near the WLPZ.

**Major concerns of using heavy equipment in the riparian zone.**

- a. Soil Compaction, Runoff, and Changes to Site Productivity
- b. Surface Erosion and Stream Sedimentation
- c. Nutrient Input and Cycling
- d. Mass Wasting and Stream Sedimentation
- e. Flow and Energy Characteristics, Summer Stream Flow
- f. Light Availability and Energy Dynamics
- g. Post-Harvest Forest Stream Temperatures
- h. Post-Harvest Forest: Exotic and Invasive Species
- i. Post-Harvest Forest: Residual Stand Damage
- j. Post-Harvest Forest: Adequate Slash *Disposal and Fuel Loading*
- k. Post-Harvest Forest: Botanical Resources
- l. Riparian and Aquatic Wildlife

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**BMPs identified in peer-reviewed literature:**

1. Conduct operations only under dry or frozen soil conditions, or over snow
2. Use tracked equipment
3. Plan skid trails with attention to minimizing soil disturbance; clearly flag the skid trail; and include the Licensed Timber Operator (LTO) in the planning process, when possible, to ensure implementation of management objectives
4. Use skid trails with no sharp turns when possible
5. Place slash on the equipment pathway to reduce soil compaction
6. Minimize equipment passes on a single track
7. Implement equipment exclusion on areas that are steep or unstable and pre-flag these boundaries
8. Avoid disturbance to flood prone areas and poorly drained soils
9. Do not store or use chemicals in WLPZs; no refueling or servicing equipment in WLPZs
10. Avoid hydrologic connectivity between the area of disturbance and the watercourse.
11. Harvest on deep slash layers when possible
12. Do not place slash into watercourses or in areas where it is likely to enter the watercourse
13. Maintain adequate canopy cover, especially on the south side of watercourses
14. Maintain adequate sources of large woody debris, relevant to site-specific conditions and future needs
15. Employ directional felling away from the watercourse
16. Treat logging slash appropriately to reduce fire hazard and protect water and soil quality
17. Consider gap creation as a management technique
18. Use longlining.

**End of Question**

## QUESTION IX- FOREST POLICY

### OBJECTIVE:

Demonstrate your knowledge of the laws and agencies a RPF must work with to facilitate timber operations in California.

### SITUATION:

Assume that you have the responsibility for planning and supervising harvesting operations on an area of privately owned forestland in California.

### QUESTIONS:

- 10%**            1. Identify **five (5)** separate **State** regulatory agencies, Boards or Commissions with which you may have to work with in preparing and administering your THP.
- 45%**            2. **List** and briefly **discuss** the **principal** laws through which each of the State agencies, Boards or Commissions (that you have listed in Question 1 above) have authority to impact forest practices.
- 45%**            3. For the **five (5)** State agencies, Boards or Commissions that you listed in Question 1, **explain** how each interacts with other State agencies, Boards or Commissions and **meets** its regulatory obligation.

**END OF QUESTION**

## QUESTION X- Management

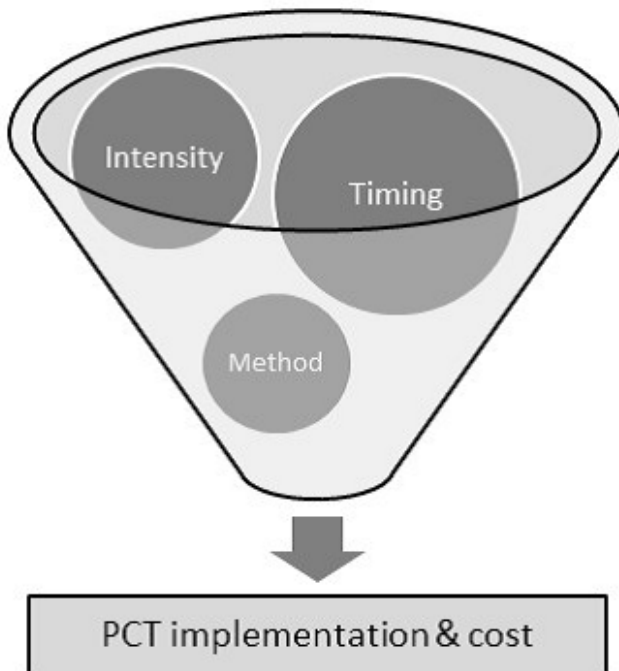
**OBJECTIVE:** Demonstrate your ability to plan and execute precommercial thinning for reforestation in California.

**SITUATION:** PCT plays an important part in the reforestation process.

### QUESTIONS:

**5%** 1. What is precommercial thinning following reforestation?

**15%** 2. The diagram below describes the decision space (factors) manipulated during planning for precommercial thinning. Briefly discuss each element in the decision space and how they affect PCT implementation and cost in a mixed species plantation.



**50%** 3. Discuss the consequences of decisions made when planning precommercial thinning. Include in your discussion effects on growth, wildfire, growing stock, wood quality and pest management. 10 Points for each element.

**15%** 5. How should a RPF decide the timing of PCT after reforestation planting?

**15%** 5. How should a RPF decide the intensity of PCT after reforestation planting? Give a numeric example showing your work.

**End of Question**

**END OF EXAM**

24 October 2024