

2014 NASP IMDS Instructional Plan

Title: Inventory/Monitoring and Decision Support (IMDS)
Dates: September 15-26, 2014
Class Location: Peavy Hall 272, Oregon State University, Corvallis

PERSONNEL

Coordinator/Instructor: JB - **John Bailey** - Associate Professor
 Instructor: LG – **Lisa Ganio**, Associate Professor
 Instructor: JS - **John Sessions**, Professor
 Instructor: KB - **Kevin Boston**, Associate Professor
 Instructor: GL – **Greg Latta**, Faculty Research Associate
 Instructor: ESM – **Erin Smith-Mateja**, USFS-FVS Group
 Instructor: NY – **Matt Powers**, Assistant Professor

COURSE OVERVIEW

This course spans two weeks (76 hours total) and includes daily progress assessments, an integrative group project (and presentation), and a final quiz. It addresses the eight basic NASP/IMDS topics at the specified contact-hour intensity (per Table 1). Instructors are identified by initials and color (above). The weekend field trip is not shown but is a recommended activity for all participants to reinforce IMDS concepts and share information.

Table 1. Schedule overview by topic and instructor.

| | Monday | Tuesday | Wednesday | Thursday | Friday |
|-----------------------------|---|--|---|---|--|
| Week 1 (9/15 -19) | JB – Welcome; LG – Statistics overview (a.m.); JB- From samples to models to plans (p.m. field) | LG - Statistical inference (a.m.); GL – Investment analysis principles (p.m.) | LG – Sampling for inventories and monitoring (a.m.) GL – Social cost/benefit analysis (p.m.) | LG – Simple Regression and Covariance (a.m.) KB - Legal requirements for forest planning I | KB - Legal requirements for forest planning II JB – Density and productivity metrics (p.m.) |
| Week 2 (9/22 –26) | JS - Forest Regulation w/ exercise (a.m.) ESM- G&Y models intro; FVS start-up (p.m.) | ESM- G&Y models cont.; FVS project work (a.m.); JB – Field data collection, mgt. and use (p.m.) | MP – Inventory and monitoring principles (a.m.); JS - Landscape Planning tools (p.m.); | MP – Inventory and monitoring uses (a.m.); JB – Modeling, projection and DMDs (p.m.); | JB – Final quizzes and project presentations! + evaluations (1/2 day only) |

The instructional plan on the following pages details each day by instructor, as well as general lecture and exercise intervals, describing:

- **learning objectives** (LO) for specific in-class/lab activities and field,
- content and flow of **lectures**, **computer labs** or **field exercises**, and
- important summary ideas and **discussion questions**.

Each day begins at 8:00 am in the OSU classroom (Peavy Hall 272) and concludes at or before 5:00 pm. Breakfast is provided at the hotel prior to class (*via* a coupon); there is one hour available for lunch at noon, typically using a local dining card. We will often do an organized dinner at 6:30 pm, or participants can make their own plans on their own schedule.

DAILY PLAN – WEEK #1; MONDAY

< Statistics pre-work assignment **DUE**; 20 points >

8:00 am in historic Peavy Hall, room 272 ("PVY 272"), on the beautiful OSU campus
Welcome and introductions – How this week works. What you should learn. Expectations?

Monday morning: Statistics Overview: Statistics and Sampling for Mensuration – Lisa Ganio

LO: Basic terms and concepts in forest mensuration, sampling and statistics

LO: Central tendency, variability, and complex distributions

Lecture blocks: 8:30-12:00, with a *Morning Break*

- 1) Concepts of statistics – what do you know and what do you use?
 - a. Characterizations of distributions: Continuous vs discrete; shapes and names
 - b. Descriptive measures
- 2) Measures of central tendency: mean, median, mode
- 3) Measures of spread; standard deviation, min/max, range
- 4) Quantiles are always good to use.
- 5) Accuracy and Precision : Comparison vs estimation, representation and sampling
 - a. Achieving representative samples
 - b. Bias is a long-run property – using unbiased statistics
- 6) Definition of precision

Ideas for discussion:

- 1) How can I tell if my data are normally distributed?
- 2) How does the size of my sample affect my ability to characterize the distribution?
- 3) What do the distributions of common mensuration variables look like?

LUNCH CATERED TO PVY 272**Field Trip to McDonald-Dunn Forest: 1:00-5:00 – John Bailey**

LO: Basic terms and concepts in forest mensuration, sampling and statistics

LO: Measures of tree productivity, site index and site class; site index charts

Instructional Points:

- 1) Review of mensuration techniques (types and oddities) and stand dynamics
- 2) Introduction to PNW trees and forest types, as well as regional management patterns
- 3) Silviculture research plots relative to current management trends
- 4) Project Assignment**

Discussion points:

- 1) What, if anything, makes silviculture and IMDS unique in the PNW?
- 2) How will you carry this information back to your home offices?

5:00 Drop off at the hotel;

Group dinner at 6:30 in Downtown Corvallis (American Dream Pizza: 214 SW 2nd St.)

DAILY PLAN – WEEK #1; TUESDAY

<8:00am Quiz (PVY 272) – on statistics; 20 points>

Tuesday morning: Sampling and Statistical Inference – Lisa Ganio

LO: Basic terms and concepts in forest mensuration, sampling and statistics

LO: Relevant statistical concepts to real inventory and monitoring situations

Lecture blocks (PVY 272): 8:10-12:00, with a *morning Break*

1. How do we know if a statistic is precise? What are sampling distributions?
2. Confidence interval for the mean and the standard error
3. Testing a statistical hypothesis: a T-test.
4. Achieving pre-set precision – the sample size equation

Computer Exercises (Peavy Hall, room 240): 10:15–12:00

Discussion points:

- 1) What is the difference between a standard error and a standard deviation?
- 2) Can we change the distribution of our data by increasing the sample size?
- 3) Can we change the sampling distribution of a mean by increasing the sample size?
- 4) Why is the purpose of our sampling needed to design the sampling plan?

LUNCH QDOBA DELIVERY TO PVY 272**Tuesday afternoon: Economic Principles – Greg Latta**

LO: Project-level investment analysis

LO: Finding economics data on the web

Lecture blocks (PVY 272):

- 1) 1:00-2:00 – Arithmetic of investment analysis, with *Snack Break*
 - a. Inflation, and simple discounting and compounding
 - b. Series Equations
- 2) 2:00-2:45 – Using investment analysis
 - a. NPV, BCR, and IRR
 - b. Discount rates

3:00 - In-class exercises (please bring your laptops or share)

- 1) Compute nominal and real log price growth rates from ODF log price data.
- 2) Finding forest economics data on the web.

Discussion points:

- 1) How can investment analysis be used in forest planning?

5:00 return to the hotel; dinner on you own with campus dining card or individually on per diem

DAILY PLAN – WEEK #1; WEDNESDAY

<8:00 am Quiz (PVY 272) – on economics; 20 points>

Wednesday morning: Introducing Planning for Inventories and Monitoring – Lisa Ganio

LO: Introduce forest inventories and current/appropriate uses for multiple objectives

LO: Relevant statistical concepts to real inventory and monitoring situations

Lecture blocks (PVY 272): 8:15-12:00, with a *morning break*

- 1) The role of randomization and replication in producing accurate and precise statistical descriptions for inventories/monitoring
- 2) Developing strategies for multiple objectives; considerations of scales and sample sizes
- 3) Related measurements: linear and non-linear correlations
- 4) Images and statistics to describe correlations
- 5) Introduction to regression

Discussion points:

- 1) How do you choose one inventory or monitoring approach over another?

LUNCH JIMMY JOHN'S DELIVERY**Wednesday afternoon: Economic principles and cost-benefit – Greg Latta**

LO: Basic terms and principles of forest economics

LO: Social cost benefit analysis and what it entails

Lecture block (PVY 272): 1:00-3:00, with *Snack Breaks*

- 1) Cost-Benefit Analysis (concepts and principles)
 - a. What is economics about?
 - b. The general framework of cost benefit analysis
- 2) Measurement and “adding up” issues
 - a. Placing a dollar value on things that matter
 - b. Adding up over people – fairness and “Who pays?”
 - c. Adding up over time – discounting issues

Lecture block (PVY 272): 3:15-5:00

- 1) Finding minimum cost stand management regimes that meet non-timber criteria
- 2) Evaluating the impact of active management for old forest structure on WP markets

Discussion points:

- 1) What role(s) can economics play in public forest land management decisions?
- 2) What cost benefit analysis can and cannot tell policy makers and forest managers.
- 3) What does the discount rate signify to a private timberland owner? ... to a public agency managing forest land on behalf of society?

6:30 Group dinner at El Sol de Mexico restaurant on 9th St.

DAILY PLAN – WEEK #1; THURSDAY

<8:00 am Quiz (PVY 272) – on statistics; 20 points>

Thursday morning: Regression and Covariance – Lisa Ganio

LO: Relevant statistical concepts to real inventory and monitoring situations

LO: Correlation and regression analyses – computer lab exercises

LO: Relationships among time, tree growth, mortality and economics

Lecture (PVY 272): 8:10-10:00

- 1) Introduction to regression – describing trends in means
- 2) Deciding if linear regression is an appropriate description
- 3) Predicting means versus predicting observations
- 4) Using regression to increase precision

Discussion points:

- 1) How many distributions does one regression line describe?
- 2) Why do we make the assumption that all the regression distributions have the same variance?

Computer Exercises (PVY 240): 10:00-noon: Working with regression

LUNCH – pizza in the Peavy Courtyard (from Woodstock's Pizza)

Thursday afternoon: Planning and Legal Requirements for Planning I – Kevin Boston

LO: Legal context for federal land management and planning

LO: Relationship between forest activities and other Federal Acts

LO: Implications for current Forest Planning activities

Lecture blocks (PVY 272): 1:00-5:00; with *Breaks*

- 1) Review and discussion of “**The Acts**” that influence forest planning directly
 - a. National Forest Management Act
 - b. Federal Land Policy and Management Act
 - c. National Environmental Planning Act

5:00 return to hotel; Dinner on you own, with campus dining card or individually on per diem

DAILY PLAN – WEEK #1; FRIDAY

<8:00 am Quiz (PVY 272) – economics assignment DUE; 20 points>

Friday morning: Planning and Legal Requirements for Planning II – Kevin Boston

- LO: Legal context for federal land management and planning
- LO: Relationship between forest activities and other Federal Acts
- LO: Implications for current Forest Planning activities

Lecture blocks (PVY 272): 8:15-12:00; with *Breaks and lunch*

- 2) Continue review of “The Acts” that influence forest planning activities indirectly
 - d. Endangered Species Act
 - e. Clean Water Act – non point and point source
 - f. Clean Water Act – wetlands issues
- 3) Existing cases that are influencing forest planning activities

Discussion Points:

- 1) What are the requirements under these various Acts, and how have they been interpreted by the Agency through the CFR’s?
- 2) How are the interpretations and implementations of the acts changing with recent court rulings and agency rulings?

LUNCH OSU CATERING DELIVERY**Friday afternoon: Site Productivity, Density and Growth/Yield – John Bailey**

- LO: Factors impacting site productivity in given situations
- LO: Explain the importance of manipulating site productivity and stand density
- LO: Terms, components and processes important to tree and stand growth

Lecture blocks (PVY 272): 1:00-5:00, with a 3:00 *Snack Break*

- 1) Components of stand growth (birth, growth, and mortality,)
- 2) Basic concepts of site productivity and density as determinates of stand growth:
 - a. Physiological mechanisms for growth, mortality, and competition
 - b. Measures of site quality (direct and indirect); site index theory and use
 - c. Measures of density; stand vs. tree plasticity and value
- 3) Review of tree growth – primary and secondary – and its measurement/analysis
- 4) PAI and MAI relative to stand dynamics; management options

Discussion points:

- 1) **Why** are productivity and density so fundamental to management?
- 2) How do inventory procedures impact forecasts of future stand conditions?

Leave for the Field Trip to the beautiful Oregon Coast

Coast Weekend Escape

Friday:

Field trip: beginning **5:00pm**, with travel snacks

- 1) Seeing forest management and stand development stages in the Oregon Coast Range.

Discussion points:

- 1) What tools are available to manage density and mortality in Douglas-fir forests?
- 2) How do these observations relate to “home” forests?

*6:30pm Group dinner at **Mo's** (seafood);*

9:00PM Bonfire on beach near Shilo Inn

Saturday:

Buffet breakfast at Shilo Inn (available 6:30-7:45).

8:00am: departure for field trip (hosts: **Stu Johnston, Dan Segotta and Eric Werner**) into the Siuslaw National Forest to see:

- Stewardship commercial thinning sales (for promoting late-successional reserve habitat under the Northwest Forest Plan), and
- Cape Perpetua National Scenic area (for recreation planning and general afternoon open wandering)

Sandwich lunches at Cape Perpetua

6:30pm Group dinner at Rogue Brewery (buffet style) back in Newport, with brewery tours and shopping time.

Sunday:

Breakfast at the Shilo Inn restaurant, charged to your room (whenever you get up).

11:00am check-out and load vehicles; then three hours of free time (*lunch on your own*) in Newport until our return trip to Corvallis,

2:00pm Leave Shilo Inn parking lot for Corvallis Garden Hilton, arriving 3:30ish

Dinner on you own, with dinning card or individual on per diem

DAILY PLAN – WEEK #2; MONDAY

<8:00 am Quiz (PVY 272) – on policy and law; 20 points>

Monday morning: Forest Regulation – John Sessions

LO: Basic sustained yield principles related to timber resources and law, LSY

LO: Calculate and compare area and volume control

LO: Basic harvest schedules and allocation problems

LO: Regulation concepts with economic and sustainability principles

Lecture blocks (PVY 272): 8:15-9:45, then a *Break*

- 1) Sustained yield **definitions and principles**; even/uneven-aged management
 - a. Area vs. volume regulation – where and when
- 2) Harvest scheduling and allocation; timber and non-timber resources
- 3) Spatial vs. non-spatial analysis

Computer exercises (Peavy Hall, room 240): 10:00-noon

- 1) Binary-search forest regulation exercise – area control, volume control
- 2) Non-spatial regulation with timber/non-timber outputs

Discussion points:

- 1) What is the desired future condition and dynamics?
- 2) How does one measure/inventory if one plan is better than another?
- 3) Balancing the means with the ends.

LUNCH AT MARKETPLACE WEST (campus dining cards)**Monday afternoon: Modeling – Erin Smith-Mateja**

LO: Compare growth models and project future stand conditions

LO: Components of stand growth and yield tables

LO: Example data sets including all the above elements – computer lab exercises

Lecture blocks (PVY 272): 1:00-2:45, then *Snack Break*

- 1) Why models are used
- 2) Types of Forest Growth Models
- 3) Describe the primary components of an individual tree model
- 4) Introduction to the Forest Vegetation Simulator

Computer exercise (PVY 240): 3:00-5:00 – Erin Smith-Mateja

- 1) Begin FVS simulation exercises

Discussion points:

- 1) Are our modeling tools adequate to address current issues in forest management? What do we do well and where do we need improvement?

*6:30 Group dinner at local **Laughing Planet**, downtown Corvallis*

DAILY PLAN – WEEK #2; TUESDAY

< 8:00 am Quiz (PVY 272); on regulation; 20 points >

Tuesday morning: Modeling (con't) – Erin Smith-Mateja

LO: Example data sets including all the above elements – computer lab exercises

LO: Compare growth models and project future stand conditions

Lecture blocks (PVY 272): 8:15-9:00

- 1) Addressing common issues about FVS modeling
- 2) **Project review/Q&A – John Bailey**

Computer exercise (PVY 240): 9:00 -12:00, with a 10:00 *Morning Break*

- 1) Complete FVS exercises
- 2) Begin model runs for the **integrative group project**

Discussion points:

- 2) What are the differences among FVS variants, and why?

LUNCH AT MARKETPLACE WEST (campus dining cards)**Tuesday afternoon field trip (1:00pm): Data Collection and Management – John Bailey**

LO: Field data collection, management and analyses

LO: Synthesizing data/information into silvicultural prescriptions

Instructional blocks (in the field with surface fuels/carbon data collection):

- 1) Planning for data collection: preparing data sheets (paper vs. electronic)
- 2) Field data management and security
- 3) Including **meaningful data summaries** and figures into prescriptions
 - a. Age distributions and stand tables RULE!
- 4) Identifying thresholds and patterns – even-aged and uneven-aged distributions

Discussion points:

- 1) Common pitfalls to field data collection and use in prescriptions.
- 2) Given the silvicultural toolbox, what data and information do you need for your sites?

Dinner on you own, with campus dining card or individually on per diem

DAILY PLAN – WEEK #2; WEDNESDAY

<8:00 am Quiz (PVY 272); on growth modeling; 20 points>

Wednesday morning: Forest Inventory and Monitoring Principles – Matt Powers

LO: Sampling schemes and intensities, including permanent plots

LO: Sample size, stratification and proportional allocation of plots

Lecture blocks (PVY 272): 8:15-12:00, with a 10:00 *Morning Break*

1. Sources of sampling error
2. Sampling designs (simple, systematic, stratified, double, cluster, and multi-stage)
3. Plot design (fixed vs. variable radius, size, nested, edge effect)
4. Optimal allocation for sampling – determining sample size
5. Forest inventory “technology”

Discussion points:

1. When can/should you stratify your sampling design?
2. Temporary vs. permanent plots?
3. What do you see the future holding for large-scale inventories and monitoring?

LUNCH AT MARKETPLACE WEST (campus dining cards)**Wednesday afternoon: Forest Planning – John Sessions**

LO: Basic principles of land use planning and forest planning

LO: Vegetation management and planning decisions at multiple scales

LO: Connect natural resource policy and social impact analyses

LO: Decision support modeling appropriate for Forest Planning issues

LO: Integrate various inventory and socio-economic analyses

Lecture blocks (PVY 272): 1:00-2:45, then a *Snack*

- 1) Standard frameworks for **decision making**
- 2) Prescriptions – the key building blocks
- 3) Spatial goals and landscape planning
- 4) Available tools for forest planning

Computer exercises (PVY 240): 3:00-5:00

- 1) Planning for a *small* watershed – an example

Discussion points:

- 1) Why plan at all, and what is THE fundamental planning unit in forestry?
- 2) How do we balance growth and yield of timber vs. non-timber resources?
- 3) Is there a difference between a “goal” and a “constraint?”

6:30 Group dinner at a Mexican “burrito line” place near campus – Chipotles

DAILY PLAN – WEEK #2; THURSDAY

<8:00am Quiz (PVY 272) – on forest planning; 20 points>

Thursday morning: Inventory and Monitoring Needs and Challenges – Matt Powers

- LO: Information needs assessments (e.g., for adaptive management)
- LO: Transition from single samples/inventories to monitoring frameworks
- LO: Basic terms and principles of monitoring relative to forest planning
- LO: Effectiveness, implementation and validation monitoring
- LO: Analyze and interpret monitoring data and incorporate into Forest Plan revisions

Lecture blocks (PVY 272): 8:15-noon, with *Break*

- 1) Types of monitoring
 - a. Implementation, effectiveness, compliance, validation, growth & yield, and change monitoring
 - b. Design elements of monitoring: establishing the objective, temporal and spatial scales, baselines, measurement precision, and analysis
- 2) Examining assumptions
- 3) Inventory and monitoring needs and challenges

Discussion points:

- 1) How does monitoring fit into the big picture around the Agency?
- 2) Are the desired results being achieved currently relative to NEPA and such?
- 3) How do we design a monitoring plan that is adaptable to future technology and policy changes?

LUNCH AT MARKETPLACE WEST (campus dining cards)**Thursday afternoon: Density and Vegetation Models (con't) – John Bailey**

- LO: Components of stand growth and yield tables
- LO: Metrics of growth (e.g., density management diagrams)

Lecture blocks (PVY 272): 1:00-2:00, then *Break*

- 1) Density management diagrams and stand table projection (simple growth models)
- 2) Management impacts on tree and stand structure, value and wood quality

Discussion points:

- 1) What confidence should we have in these simple tools and projections?
- 2) What about potential effects of climate change?

Computer exercise (PVY 240): 2:00-5:00

- 1) Stand Table Projection
- 2) Work on FVS runs for the **Integrated Project**

Dinner on you own, with campus dining card or individually on per diem

DAILY PLAN – WEEK #2; FRIDAY

<8:00am Quiz (PVY 272) – on inventory and monitoring; 20 points>

Friday morning (PVY 272): Integrated Group Project presentations – John Bailey

LO: Cement knowledge through personal examples and project work

8:30-11:00 Group presentations on modeling problem (20 points each)

Approximately 15 minutes per group, plus questions –

Morning Break at the half-way point

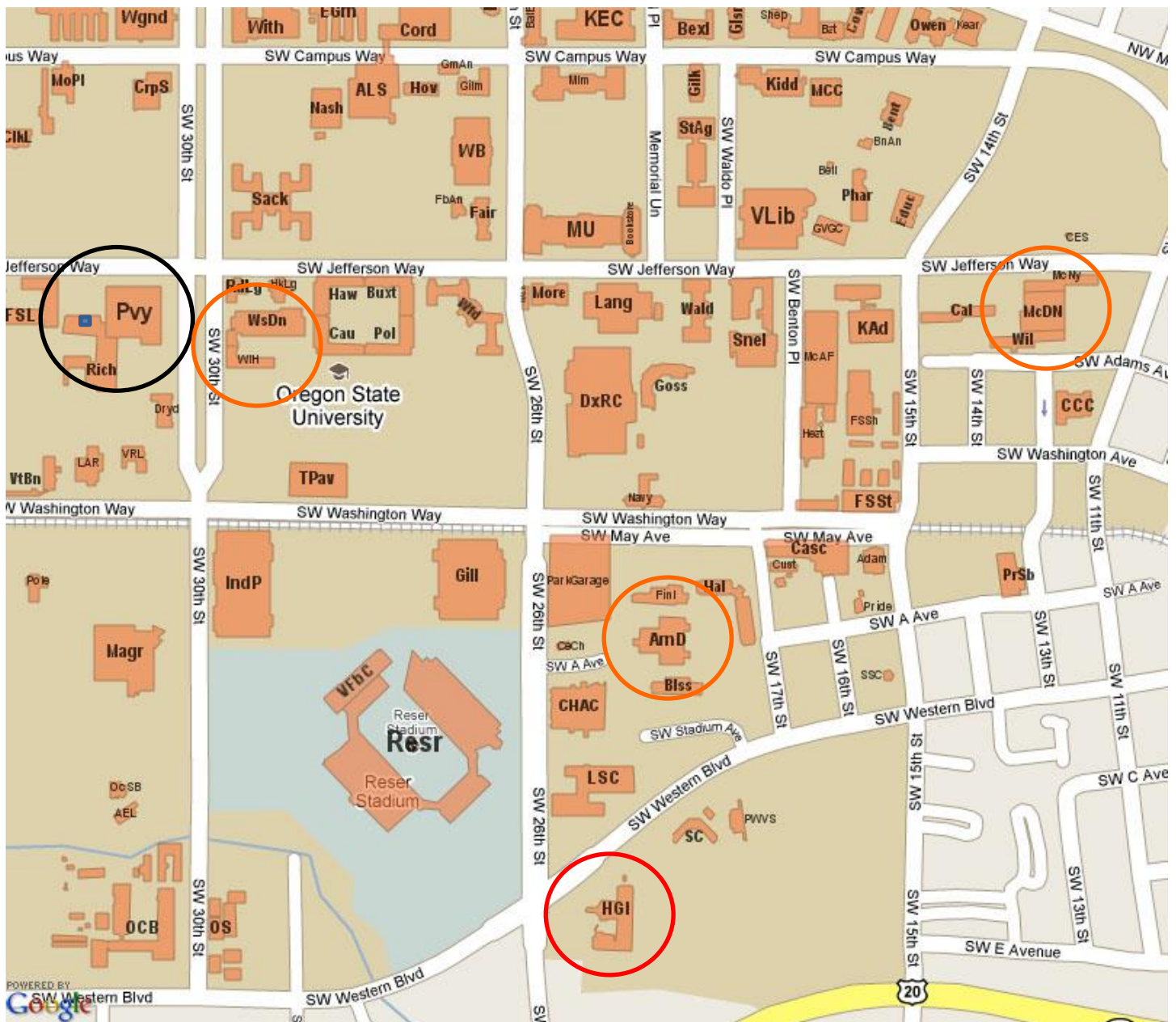
<Group Projects DUE (100 POINTS)>

11:00 Course Evaluations and Student Awards

BOX LUNCHES retrieved in PVY 272 – with farewells and wishes for safe travel.

Getting home:

Portland departures: HUT shuttle departs Corvallis at **12:00pm**, arriving at PDX about 2:30pm



Integrative Group Project (4-person teams)

All silvicultural prescriptions have three fundamental components:

1. A detailed site/stand description with data that is relevant to published and interpreted forest management objectives and likely stand management actions,
2. Component silvicultural activities (tools and techniques) and their direct impacts on stand development and ecosystem processes/services, and
3. Anticipated, longer-term stand development and ecosystem responses following proposed management actions and an analysis of alternatives.

Silviculturists develop and choose their tools/techniques based more on anticipated long-term ecosystem development **RELATIVE TO** the management objectives than on current stand conditions. For this exercise (and to reinforce the learning objectives of the IMDS module of NASP), we will focus on the third and last component using an example stand for a home District within your group. You might look at each and ponder the advantages and disadvantages of each before you choose.

DUE Friday morning of week #2; 10-page maximum plus supporting tables and figures. Your written presentations should have four parts:

Part I. Site/stand description (10 points) – Use summary model output and appropriately computed statistics to synthesize tables and figures that describe your existing stand and its projected development over time in the absence of future management.

Part II. Scoping summary (10 points) – Address the interested publics and summarize three basic areas:

- 1) The extent of the land area of interest,
- 2) Broad planning objectives of the Forest, and
- 3) Relevant laws and anticipated management/environmental issues for the stand.

This scoping effort should conclude with a brief introduction of at least three proposed “alternatives” that span the range of options available to address these management objectives and issues.

Part III. Prescription Alternatives (70 points) – The main portion of this project concerns the details associated with 3-5 silvicultural alternatives and their projected effects on growth and development, in general, for the stand – one each per group member. This is the true “prescription”, describing each tool/technique and its application IN SOME DETAIL with a comprehensive timeline and justification of the various tools and techniques chosen as they were **modeled**. Each alternative should have a complete analysis of 50-year development (economic, ecological, and sociological responses) following implementation of treatments, but focus attention on the most interesting scenarios and contrasts. This section should consider all the decisions relevant to land management objectives and other scoping issues.

Part IV. Record of Decision (10 points) – Create a 1-page decision matrix (scoring) and associated synthesis text that summarizes the pros and cons of all alternatives (including a “no-action” alternative from the site description) for the stand. Consider legal, planning and economic dimensions as well as the basic data (statistics), model runs and silviculture. Assume you’ve done an EA with all consultations for the area.

Your oral presentations (also Friday_morning; 20 points) should **focus on** Parts III and IV after a quick introduction, since you all will only have ~15 minutes to present; therefore, you should use only a few slides per alternative – get to the point.