DOCUMENT RESUME

ED 429 652 JC 990 233

TITLE	Employers in Natural Resources--What They're Telling Us.
INSTITUTION	Chemeketa Community Coll., Salem, OR.; Northwest Center Sustainable Resources, Salem, OR.
SPONS AGENCY	National Science Foundation, Arlington, VA. Div. of Undergraduate Education.
PUB DATE	1998-00-00
NOTE	72p.
CONTRACT	DUE-9813445
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	*Community Colleges; Conservation (Environment); Employer Attitudes; *Employers; Environmental Education; *Job Skills; Job Training; *Natural Resources; School Community Relationship; Two Year Colleges

ABSTRACT

This reports describes the ways in which model programs created by the Northwest Center for Sustainable Resources (NCSR) are based upon employers' needs and recommendations. An introductory essay describes Geographic Information Systems (GIS), a form of remote sensing technology with satellite imagery, that is a promising tool for analyzing natural resource management and policy alternatives. The report outlines a workshop on defining environmental technology, with a chart that highlights the broad job functions for the following occupational titles and technical positions: (1) aquatic ecology; (2) botany; (3) terrestrial ecology; (4) fire management; (5) forestry; (6) forest engineering; (7) geographic information systems; (8) geology; (9) hydrology; (10) range technician; (11) rare/endangered species specialist; (12) recreation technician; (13) soil conservancy; (14) wetlands technician; and (15) wildlife technician. Next, the report provides transcripts of NCSR focus group interviews conducted at Chemeketa Community College with representatives of four related industries. The report also provides "DACUM Charts" ("Developing A CurriculUM") that outline job duties and required knowledge for six jobs in the natural resources area. Finally, the report includes charts regarding the partnerships between NCSR and the following community colleges: Feather River College; Central Oregon Community College; Chemeketa Community College; Grays Harbor College; Western Center; and Shasta College. (AS)

NCSR
EDUCATION FOR A SUSTAINABLE FUTURE

EMPLOYERS IN NATURAL RESOURCES —WHAT THEY'RE TELLING US

A REPORT OF THE

NORTHWEST CENTER FOR SUSTAINABLE RESOURCES
NCSR

DUE # 9813445

FUNDING PROVIDED BY THE NATIONAL SCIENCE FOUNDATION

CHEMEKETA
COMMUNITY COLLEGE

The Northwest Center for Sustainable Resources is an Advanced Technological Education program funded by the National Science Foundation.

As a Center of Excellence, the project's goals of creating innovative model programs are closely tied to "what employers are telling us."

Please read about the many ways the Center's models are based on employers' needs and recommendations.

Susie Kelly
Director, Northwest Center for Sustainable Resources

This project was supported, in part
by the
National Science Foundation
Opinions expressed are those of the authors
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Schriever serves as the Center's Industry Advisor. In this role, Schriever and Pacific Meridian provide needed input from industry into the Center's curriculum products and other activities. Schriever writes about the promise of GIS technology in natural resource fields.

Over the past decade, Geographic Information Systems (GIS) have emerged as promising tools for analyzing natural resource management and policy alternatives. Implementation of these tools has been prevalent in the western United States where GIS has been used for a variety of purposes including analysis of endangered species habitat, timber harvest scheduling, watershed assessment, monitoring of cumulative effects, fire management, ecological modeling, and growth management. Most western states and federal agencies use GIS to assess, manage, and regulate natural resources and natural resource management practices. In addition, many major western private landowners utilize GIS for resource management and planning. Some of these landowners include: Weyerhaeuser, Willamette Industries, Sierra Pacific Industries, Boise Cascade, Crown Pacific Corporation, Potlatch Hancock Timberlands, Potlatch, Plum Creek, Louisiana Pacific, and Roseburg Resources.

GIS and remote sensing provide resource managers with the ability to: 1) inventory and monitor resources; 2) plan both site specific and regional management; and 3) analyze policy alternatives.

Numerous applications have shown the usefulness of GIS and remote sensing in inventory and monitoring of natural resources. The Forest Service in Oregon and Washington was one of the first agencies to fully implement GIS remote sensing for ecosystem mapping when the technology was implemented to support inventory of spotted owl habitat. GIS is also a powerful management and policy analysis tool because it allows natural resource managers to simulate multiple future conditions and their resulting impacts across space. By linking possible future conditions to values, natural resource managers can use GIS to narrow options to a spatially feasible set.

GIS also facilitates sensitivity analysis of critical assumptions allowing managers to focus on critical areas of uncertainty. For example, Washington State's Department of Natural Resources developed a GIS model to help prioritize watersheds as to their probability of experiencing cumulative effects from forest management activities. The strength of these types of modeling efforts lies in the fact that they can be run multiple times with varying

assumptions. This allows analysts and managers to identify variables that significantly affect resources of concern and prioritize implementation of enhancement efforts aimed at protecting these resources.

GIS and remote sensing hold tremendous potential as tools for facilitating natural resource management. Use of currently available satellite imagery is rapidly expanding. Because increasing demands on the land are increasing land values, the need to use GIS and remote sensing technology will continue to grow.

Future satellite launches and advancements in GIS software will provide new opportunities for increasing our understanding of the status of natural resources, their interactions, and change over time. However, the technologies can be both a panacea and a Pandora's box. The panacea exists in the promise of the technologies to meet the challenges of natural resource inventory, monitoring, planning, and policy analysis. The Pandora's box contains the pitfalls of choosing the wrong imagery, using the technology incorrectly, capturing data poorly, miscommunication of information, conveying incorrect results, and overselling the capabilities. This underscores the need for skilled and trained technicians, like those graduating from Central Oregon Community College's and other NCSR-related GIS programs. We need people who are trained in these technologies to make sure that the technology is not used incorrectly, and that data is not captured poorly so that communication of information is appropriate and logical.

Defining Environmental Technology Workshop

March 13-15, 1996, St. Louis, MO

Jim Kiser
Senior Operations Specialist
Weyerhaeuser Company, Federal Way, WA

Mark Lawrence
Associate Manager
Salem District Bureau of Land Management

Jim Kiser, who is currently employed as an Instructor, Forest Engineering, Oregon State University, and Mark Lawrence participated in the "Defining Environmental Technology" Workshop coordinated by the Advanced Technology Environmental Education Center (ATEEC), an ATE Center of Excellence like NCSR. The Workshop's aim was to define and clarify, for the nation, what is meant by the "environmental technology field," and to identify specialty areas for environmental technicians. The report for the workshop, "Defining Environmental Technology," contains the following section (somewhat modified by Kiser) that identifies natural resource management job titles and functions for technicians. It should be noted that Kiser and Lawrence described even more technician job titles, but in the interest of brevity, some were left out. Thus, the titles listed should serve as a broad sampling, not a comprehensive listing, for existing positions in the profession.

TECHNICIANS IN NATURAL RESOURCES MANAGEMENT	
OCCUPATIONAL TITLES	**BROAD JOB FUNCTIONS**
AQUATIC ECOLOGIST **AQUATIC/TERRESTRIAL HABITAT RESTORATION TECHNICIAN**	▸ Conduct surface and groundwater inventories and studies (i.e., watershed analysis) ▸ Identify and delineate wetlands based on plant/animal species and hydrology ▸ Implement plans to improve aquatic habitats ▸ Implement wetland restoration and construction activities ▸ Interpret water quality information ▸ Introduce rare/endangered species into ecosystems ▸ Propagate and plant woody and non-woody species
BOTANY TECHNICIAN	▸ Assist in operational forestry ▸ Assist in species breeding/propagation programs ▸ Identify and delineate wetlands based on plant/animal species and hydrology ▸ Implement plans to improve aquatic habitats ▸ Implement wetland restoration and construction activities ▸ Inventory forest stands ▸ Propagate and plant woody and non-woody species
ECOLOGIST TECHNICIAN	▸ Assist in operational forestry ▸ Assist in species breeding/propagation programs ▸ Identify and control noxious weeds ▸ Implement plans to improve aquatic habitats ▸ Introduce rare/endangered species into ecosystem ▸ Inventory forest stands ▸ Propagate and plant woody and non-woody species ▸ Sample and identify aquatic organisms

FIRE MANAGEMENT TECHNICIAN	▸ Assist in development of fire management plans ▸ Assist in preparation of fire suppression and prescribed burning plans ▸ Implement prescribed burning ▸ Inventory forest stands
FISHERIES TECHNICIAN	▸ Assist with fish hatchery management ▸ Conduct surface and groundwater inventories and studies (i.e., watershed analysis) ▸ Implement farm pond management techniques ▸ Implement plans to improve aquatic habitats ▸ Operate boats and utilize seining, trawling, and electroshock equipment ▸ Practice techniques of aquaculture ▸ Sample and identify aquatic organisms ▸ Stock lakes and streams with fish
FORESTRY TECHNICIAN	▸ Assist in development of designs for the protection, maintenance, rehabilitation, or enhancement of visual resources ▸ Assist in development of fire management plans ▸ Assist in forest nursery programs ▸ Assist in laying out timber sales ▸ Assist in operational forestry ▸ Assist in preparation of fire suppression and prescribed burning plans ▸ Assist in species breeding/propagation programs ▸ Compile, verify, and analyze appraisals ▸ Conduct surface and groundwater inventories and studies (i.e., watershed analysis) ▸ Cruise timber (i.e. measure height and circumference of trees) ▸ Identify and control noxious weeds ▸ Identify and delineate wetlands based on plant/animal species and hydrology ▸ Implement prescribed burning ▸ Implement wetland restoration and construction activities ▸ Introduce rare/endangered species into ecosystem ▸ Inventory forest stands ▸ Manage and use pesticides and herbicides ▸ Prepare appraisal documents ▸ Propagate and plant woody and non-woody species ▸ Recommend silvicultural practices ▸ Scale (i.e., measure) cut logs ▸ Assist in road layout, surveying, timber harvest operations
FOREST ENGINEERING TECHNICIAN	▸ Be aware of land measurement systems; identify property lines and corners ▸ Lay out harvesting systems ▸ Understand yarding and loading timber processes ▸ Work with various transportation systems and road layout ▸ Work with various logging, road building, and other equipment ▸ Understand surveying processes and methodology

GEOGRAPHIC INFORMATION SYSTEMS (GIS) TECHNICIAN	▸ Manage spatial data ▸ Integrate data from various sources ▸ Understand cartographic conventions ▸ Geo-reference imagery; determine appropriate projections ▸ Perform spatial data queries
GEOLOGICAL TECHNICIAN	▸ Assess farmland for eligibility in federal programs ▸ Assist in checking geologic maps and reports ▸ Calculate rates of sediment production ▸ Collect and analyze geological data ▸ Collect data for use in identifying geologic structures and determine extent of formations ▸ Determine soil types and physical soil characteristics ▸ Identify fossils and rock samples ▸ Implement erosion control strategies ▸ Inventory soil conservation practices (e.g., terracing, grassed waterways, zero-till, crop rotation) ▸ Conduct surface and groundwater inventories and studies (i.e., watershed analysis)
HYDROLOGY TECHNICIAN	▸ Collect and analyze water samples ▸ Comply with local, state, and federal water pollution control acts ▸ Conduct surface and groundwater inventories and studies (i.e., watershed analysis) ▸ Decontaminate sampling equipment ▸ Examine water quality and quantity from streams and aquifers ▸ Implement plans to improve aquatic habitats ▸ Interpret surface and groundwater inventory and study data ▸ Interpret water quality information ▸ Label, preserve, and store samples
RANGE TECHNICIAN	▸ Assess farm land for eligibility in federal programs ▸ Assist in development of fire management plans ▸ Assist in species breeding/propagation programs ▸ Determine soil types and physical soil characteristics ▸ Identify and control noxious weeds ▸ Identify and delineate wetlands based on plant/animal species and hydrology ▸ Implement erosion control strategies ▸ Implement wetland restoration and construction activities ▸ Introduce rare/endangered species into ecosystem ▸ Inventory soil conservation practices (e.g., terracing, grassed waterways, zero-till, crop rotation) ▸ Propagate and plant woody and non-woody species
RARE/ENDANGERED SPECIES SPECIALIST	▸ Identify and delineate wetlands based on plant/animal species and hydrology ▸ Introduce rare/endangered species into ecosystem ▸ Propagate and plant woody and non-woody species
RECREATION TECHNICIAN	▸ Assist in development of designs for the protection, maintenance, rehabilitation, or enhancement of visual resources ▸ Assist in operational forestry ▸ Comply with local, state, and federal water pollution control acts ▸ Perform park maintenance

Soil Conservation Technician	▸ Assess farm land for eligibility in federal programs ▸ Calculate rates of sediment production ▸ Determine soil types and physical soil characteristics ▸ Examine water quality and quantity from streams and aquifers ▸ Identify and control noxious weeds ▸ Identify and delineate wetlands based on plant/animal species and hydrology ▸ Implement erosion control strategies ▸ Implement wetland restoration and construction activities ▸ Interpret surface and groundwater inventory and study data ▸ Inventory soil conservation practices (e.g., terracing, grassed waterways, zero-till, crop rotation)
Terrestrial Ecologist	▸ Implement wetland restoration and construction activities ▸ Introduce rare/endangered species into ecosystem ▸ Propagate and plant woody and non-woody species
Wetlands Technician	▸ Assist in habitat restoration ▸ Identify and delineate wetlands based on plant/animal species and hydrology ▸ Implement plans to improve aquatic habitats ▸ Implement wetland restoration and construction activities ▸ Introduce rare/endangered species into ecosystem ▸ Sample and identify aquatic organisms
Wildlife Technician	▸ Implement urban wildlife management strategies ▸ Participate in tag/release and tracking studies ▸ Rehabilitate injured wildlife for release ▸ Trap and relocate wildlife
Tasks Applicable To All Titles Listed	▸ Assess environmental impact of proposed development projects ▸ Assist in habitat restoration ▸ Assist in preparing environmental documents ▸ Assist in recommendations to federal, state, local, and private organizations ▸ Calibrate, operate, troubleshoot, repair, and maintain equipment ▸ Conduct environmental education programs ▸ Develop public information programs ▸ Develop reports on findings ▸ Follow and apply local, state, and federal environmental regulations ▸ Follow established quality control procedures ▸ Follow standard operating procedures ▸ Inventory, evaluate, and assist in development of resource management strategies for sites and areas with unique scenic, recreational, historical, cultural, paleontological, and other resource values ▸ Inventory the resource (e.g., wildlife species and populations for the fisheries/wildlife technician; plant species and vegetative communities for the botany/forestry/range technician) ▸ Maintain accurate records ▸ Monitor compliance of plans/projects ▸ Organize and analyze data ▸ Oversee project maintenance ▸ Perform literature searches ▸ Prepare maps ▸ Read topographical maps ▸ Select and use proper personal protective equipment ▸ Use aerial photography ▸ Utilize computers and software ▸ Work with the public

DUE # 9813445

NORTHWEST CENTER FOR SUSTAINABLE RESOURCES

NCSR

EMPLOYER FOCUS GROUP INTERVIEWS

In 1996, Focus Group Interviews were conducted by Ara Andrea, Forest Resources Technology Instructor and NCSR Lead Program Developer, Chemeketa Community College.

Employers from the Bureau of Land Management, and key industries in the Pacific Northwest—Weyerhaeuser Company and Willamette Industries, Inc.—took part in the interviews; Andrea asked questions ("Q") and interviewees provided answers ("A"). Questions related to curriculum development objectives for the Center.

Transcripts from the interviews are edited for readability.
Susie Kelly, Director, NCSR

USDI BUREAU OF LAND MANAGEMENT (BLM)
SALEM, OREGON
DATE: OCTOBER 3, 1996

Focus Group represented by:

Resource Area Botanist (RB)
Biological Technician (BT)
Forester, Timber Sale Layout/Contracting/Special Forest Products (F/T)
Natural Resource Administrator/Timber Sales and Reforestation (NR)

Q: ***Is a 2-year Associate's degree sufficient to get technician work, or do graduates need a B.Sci.? How much "weight" is attributed to the level of education?***

A: BT: It largely depends on being the right person in the right spot. It doesn't necessarily matter whether you have a 2- or 4-year degree. There are a lot of Associate's degreed people who have gotten the positions they've wanted.

NR: Generally, the government is downsizing—I mean, we're losing positions and our permanent workforce is restricted to certain levels, and there just aren't a lot of openings to bring in a new person—whether it be a technician or a forester, or a wildlife biologist. As openings do occur, we will look at bringing in some new folks. I guess I would say that more so, than not, we would be bringing in professionals, as opposed to technicians. Because I think we would probably get more "bang for our buck" with a B.Sci. degreed person if we're going to pay a salary. These people generally have technical skills as well as better writing skills and communication skills. It depends on the individual. I'm not

saying that's the way it's going to be, but this scenario would be more likely to happen, in my opinion (i.e., we would lean towards hiring someone with a B.Sci. degree).

On the other hand, as we lose technicians due to retirements or they move into other positions and other agencies or other districts, there's going to be a point in time we'll have to fill in behind them. Technicians perform a valuable service; but I don't see a lot of these positions freeing up in the near future. Also, because we use the Civil Service selection process, the professional graduate would automatically rank out higher, and we may never get an opportunity to interview a viable 2-year-degreed candidate—overall, I think that a 2-year graduate is at a disadvantage when s/he is competing against 4-year people. I would say that this agency, more likely than not, would probably hire the professional graduate rather than the technician.

BT: It doesn't matter what degree you have—you're going to be with the agency many, many years before you have an opportunity to apply for a permanent job. A lot of that has to do with your experience as much as it does your education to get that promotion. It's not just getting out of school, and applying for and landing a job, and then expecting to work the rest of your life for one organization anymore....

NR: In forestry, we have to do environmental assessments and compliance work. We're now doing watershed analysis as a prerequisite for timber sales operations. People need to know how to write and communicate in a group setting where we have specialists around the table and some people from outside the agency. This is critical, and we've been doing this for years, but its importance is heightened. Under this forest plan [the Northwest Forest Plan, FEMAT 1993], for us to take action, it takes a lot more time up front than it ever did before.

My observation of the 2-year degree curriculum is that it's mostly "nuts and bolts"— [*how to do a job* or task]. It isn't necessarily—*[why is the job done?]*—the technical program doesn't provide the theory behind a task.

RB: A lot of the graduates don't go strictly into "pure" forestry—they are going into recreation, they're doing riparian surveys, or wildlife [studies, etc.]. Graduates are going into a whole array of different jobs....

BT: I think students definitely need to know more of *why* things are being done the way they are now. We have to look at everything as part of a larger picture, and we have to have a better understanding of the plant community [not just the commercial species], or the wildlife, hydrology, or other issues. For instance, watershed analysis is a big part of what we do now—everything is wrapped around that. [I attended Chemeketa]... and if it's the same program as when I was a student, it has to be drastically changed, with a lot more emphasis on computer usage—not so much on the Autocad-type work, but more on the technical writing and the GIS end of it.

Q: ***What levels of Geographic Information Systems (GIS) and surveying skills are needed by a 2-year-degreed student?***

A: BT: As far as plane surveying goes, it should be tied more to Global Positioning Systems (GPS). I don't even know if workers need to use transits anymore in field surveys....

NR: We have a specialized survey crew, and we don't use GIS skills, but we're going into GPS more. I'd estimate that about a third of our work involves GPS now, and this will grow. Gathering data via new technologically-advanced tools, and downloading it into the PC, will be necessary technological skills.

RB: Students need to be *introduced* to many different methodologies. I wouldn't expect a technician to be 100% competent in any of these advanced technologies, but they need to be introduced to them, and understand what applications can be made.

BT: Then if they decide they want to specialize in this area, they can continue on in a 4-year college.

F/T: Students should understand new technologies and applications so they know the *right questions to ask*—rather than knowing *all of the answers*. When graduates get out there in the workplace, they should be able to say, "I knew that technology/technological concept existed before I looked at it today"—so they know how to ask the right questions about how to use it on the job.

Q: What levels of math, communication, and writing skills do technicians need—is statistics important?

A: RB: Students will need basic algebra, trigonometry, and geometry... I don't think they need calculus (general agreement around the table). They should be able to see a statistical formula, and to at least find standard error. For instance, I think a technician should be able to take a given equation, input some data, and then they should be able to determine whether or not they need to go back out and put some more plots in. Technicians are the people who are doing the stocking surveys—they should be able to have the math skills to be able to do that; maybe they will not understand *all* of the statistics behind it, but a basic understanding for survey work.

F/T: Whether you're looking at stocking levels or the need for thinning, or special forest products surveys—you need to understand the whole concept of surveys, whether you're dealing with one meter squares or townships. The principles are similar across the board. Students need to be able to pick up a set of instructions, or manuals, and understand how they want to do a particular survey, and then go out and do it. In natural resource sampling, students need to be able to work easily with a variety of techniques, whether they're cruising, doing riparian surveys, or stand exams, or reforestation surveys. Statistics should

be part of that overall process of sampling and processing the information—*where the statistics apply in the real world of sampling.* When I took a class in statistics, we spent hours and hours with a calculator and notepad, with absolutely no concept of where the data fit into reality, because in reality you went out and you took a 20% sample and multiplied by five.

BT: We also get into sampling in our riparian surveys.

NR: In my experience, stand exam work has not required much knowledge in statistics; maybe we should be more concerned. Other than using our 3P sampling method, which is a method of selecting sample trees in a stand you want to cruise to get an idea of volume, I was trying to think of where we really get involved with variability—perhaps when we do stocking surveys, where we have a set procedure, and you lay a plot out every so often on a grid line.

F/T: Operationally, we don't get into statistics a lot, but you do as soon as you start cooperating with research and new sampling protocols—and I foresee more and more of this type of cooperation in the future. There will be needs for greater understanding of sampling protocol and variability, and technicians should know how to go back to their references and say, *"Oh yeah, I remember how that works when I have the formula in front of me."*

NR: I think that once you get outside of cruising, statistics become less important. In cruising for board foot volume measurements, you commonly use statistical data for volume expansion—that's where it's really critical, and where workers can really get hung up; also, when we do plot cruising, instead of pre-laid out strip cruises, an understanding is needed about why plots are being laid out the way they are. Especially in the private sector, where they often do percentage sampling and then blow up the volume, workers need a better understanding. Whether sampling in plots or strips, a percentage of the area is sampled, and collected data must be expanded in some way. So graduates that work in field sampling should have an understanding of pertinent statistics.

Q: How about the importance of mandatory seasonal work? Cooperative Work Experience programs for students? How would I go about making an arrangement like this with the BLM?

A: BT: Cooperative work experience is really important. I think that working either for course credit or not, students should work with agencies in different disciplines, seeing what they do and shadowing them; this allows the students to see what really goes on, to get a more rounded feeling for what they can expect to be doing in the future.

NR: We hire Chemeketa graduates in the summer, and we hire from state employment; we have several on board now. It's a great relationship, and it makes money, but when we hire a person to do a job, we don't usually give them a lot of diversity. As it turns out, we've got some things we need to get done, and those we have working often get a steady diet of

the same thing; but this works out fine with us. But if students want to get varied work experience with the BLM, I think some sort of a program [like Chemeketa's Cooperative Work Experience (CWE)] may be good. The students may not get paid, but they would get diversity and they would know a little bit more about what is being done here—the emphasis in CWE would be a little bit different than summer work. If we're paying somebody, priority work must be done; with CWE, we have a little more flexibility.

RB: There were one or two students a couple of years ago from Chemeketa, and this is how I approached my co-workers: I said, "Okay, if we had a Chemeketa student here every Wednesday for the length of the term, would you be willing to spend a day or two with them letting them job shadow you?" We used an informal approach, and that seemed to work. It seemed to help that students received credit—for both the employer in his/her willingness to participate, and, of course, for the student.

BT: Another positive aspect of CWE and other student work is that we could "weed out" the good from the bad potential employees; e.g., a lot of people who showed up to work when I ran crews had a 4-year degree, but they had never really stepped foot in the woods. They really had no idea of what it was like. They would walk on pins and needles through the slash. This also points out the need to get out more with work experience or on field trips. Sometimes our new employees are way behind because they just aren't accustomed to moving through the brush—they are too timid.

RB: Chemeketa has talked about making CWE mandatory, but something else to consider is that quite a few students get seasonal positions with the federal government and industry in the summer between their two years of classes—so most of them are getting out in the field in the summer.

BT: For visits to be effective for the students, I think students would need to visit at least four or five times. Thinking of myself, if I went and did something three times with someone, I don't think I would get enough out of it. Also, the students wouldn't have to go out with the same person every time for the overall experience to be effective.

NR: I agree—it would probably be good if students didn't go out and work with the same person—because people do different things and have different approaches to getting a job done; if I knew a person was going to be here for five Tuesdays, for instance, then I would meet with other people in the work group and schedule a variety of things to involve the student over those five days.

Q: Any additional comments on what we should put in the course work?

A: RB: *Teamwork is really important*—and I know it's difficult to do in a program. It can be difficult both for the teacher and the student—*but it's really important.* In our working environment, we hardly do anything without having a team [meeting]—working as a team includes being able to communicate and respect different people's positions—and being flexible. I think having an open mind is really important.

BT: As an added comment, I think it's really important, especially in a class like silviculture, to understand the *why* behind harvest, site preparation, planting, and site maintenance operation. It's important for students in classes to get out with the planters, in the winter, to see what really happens out there to make it work. I think the more field trips that can be arranged, the better for the students—and not just visiting a harvest unit, but seeing the whole process in action.

NR: Something else to consider is we're using fire differently now—whereas the common notion before was "the hotter the better," it's not the case anymore. We're going with lighter burns and underburning. We're trying to use fire in beneficial ways to change plant communities. Sometimes it means returning them to what they were originally [like Eastside ponderosa pine prior to strict fire control measures]. Today, a lot of trees are left for wildlife, and we also have smoke management constraints which dictate when we can burn, and how much we can burn. There is a real opportunity for work in that area down the road. We're going to keep that tool [fire], but its use will be more complicated to use than it used to be.

Also, programs should steer students towards skills in watershed analysis, new underburning prescriptions, environmental prescriptions, etc. Writing and communication skills will be extremely important in documenting these prescriptions and for planning. To meet these new regulatory requirements, public agencies have to "go the extra distance" on up-front planning, and today's and tomorrow's employees will need appropriate skills to operate in this new climate.

WEYERHAEUSER COMPANY
SPRINGFIELD, OREGON
11/7/96

One-on-one interview with Staff Silviculturist

Q: Tell me about your position—what do you do for Weyerhaeuser Company?

A: Basically, I'm involved in silvicultural aspects of planning. Predominantly, once the logging is completed, I am in charge of growing some trees. Our forestry department used to be divided into three districts, and I was in charge of the Cottage Grove District. Now [since downsizing] we're laid out differently—but basically our charge is growing trees—including site preparation, planting, precommercial thinning, fertilization, and similar work.

Q: What about hiring—even on a seasonal basis—what is the outlook?

A: We are currently in the process of a reorganization. We lost several people recently, either through retirements, or leaving—so we're down to a relatively small staff; and I

would say the prospects of hiring seasonal workers are pretty slim. If you look at the transition, and I don't think we're different from a lot of other companies, back in the late 1970s and early 1980s, we did hire the 2-year graduate. (*note:* the reorganization was at least partly due to the timber recession at this time.) At one point, I think we had about ten 2-year program graduates on our staff. During the reorganization, most of those folks went away, or were reassigned to different positions; and since then, the staff has been downsized even more. As a result, most of the staff that we have, with one exception (a fellow I work with who has about 30 years of experience), have at least 4-year degrees.

Most of our "in house" work is done with our own forestry staff, and it involves planning, day-to-day supervision, and some audit/budgetary activities. However, most of the actual work on the ground is done by contractors at this point, and I don't know how many contractors we employ, but it's fairly substantial. For example, we're getting ready for planting season now, and we contract out all of our tree planting, and all of the planting inspection. We have an inspector with every crew—but that inspector is another contractor. At this point, the majority of those who audit contract inspectors are other contractors. Right now we're in the process of doing regeneration exams on the first five years of a planting—and that's all contract work.

An evolution has occurred in the period from 1982 to today. Apparently, whereas the company hired temporary employees to do field work prior to the reorganization in 1982, they now hire out this kind of work. What happened over time was that many of the temporary workers, noticing an increasing need, established their own subcontracting businesses—and many are now successfully bidding on and completing contracts.

Q: Can you specifically describe who some of these contractors are who are out with their teams doing the field work?

A: We have professional engineers on staff that do most of our property line surveying, but some of the other specialty contracts, including new riparian layouts, where workers need to measure every tree that's in a riparian area, drive us to get extra help. So we are asking for more and more contract work to help our staff out.

Getting back to the prospects of hiring, I would say that for Weyerhaeuser, the chances of being hired directly as a technician would be pretty slim. It would have to be somebody who had quite a bit of field experience. One thing to note, however, is the median age at Weyerhaeuser is high, with most employees having 25-35 years of experience with the company, and that there may be substantial openings in the next five to ten years.

Q: Starting with specific math skills, from your perspective as a silviculturist, what is needed for upcoming graduates of programs? Can you provide some specific guidance on courses students need, including trigonometry, geometry, and statistics?

A: Our employees are always working with numbers—whether it's tree planting or any other measurement activity. Our staff needs a good command of mathematical

manipulation. Contractors—namely planting inspectors for our purposes—need to be good with numbers, with a thorough and fast comprehension of data. Contractors need to provide constant feedback to the planting crew—for example, "this is your quality, this is your spacing, this is how many trees per acre to plant,...." And they can't just sit there when it's pouring down rain, drag out their calculator, and start adding up numbers—some of that needs to be automatic. They need to be comfortable enough to sit there and say, "I'm taking eight plots, and they planted 40 trees, and there's 36 that are good quality trees, and that's 90% of them." They have to have a pretty good command of numbers—manipulating numbers quickly. The feedback needs to get back to the crew constantly, like, "Hey, you're doing good, it's in the '90s [percentile], or—Hey, you're starting to fall down—you're missing some planting spots." They need that quick command.

As far as calculus is concerned, I had calculus in high school and college, and I don't know that I've ever really used it on the job.

Statistics never hurts. The people I see in our permanent group that do better are often the ones that have a good understanding of statistics—they know what a sampling error, or a standard error, means. And sometimes we all need to go back for a refresher course—even those who have come right out of college. You need to understand what you're doing. We have certain contractors that understand it [statistics] better, and, instead of going out and saying, "You have to put in one plot every three chains on a three-chain grid," we'll tell them, "Hey, we think that's pretty good, go out and start taking some plots." There's not many contractors out there who have a good enough handle on statistics to be able to look at the card and say, "This sample's pretty good. I can run a quick analysis to see if it meets our standards or not." It would help us if we had more people who could do that. There are several contractors who have the capability, where we can say, "Hey, go out and do this reconnaissance unit, and put in plots, and if it doesn't look like it's coming out good, go ahead and add some more." Trying to get somebody to understand what we're looking for as far as quality and spacing, and to understand statistics enough to make some judgements, is kind of tough. Even in the 4-year graduates that I've seen here at the company there's a lot of people that don't have a good understanding.

For engineering and surveying purposes, you need the basics in geometry to understand the concepts; aspects include being able to understand differences in slope, making slope corrections, finding a plot radius, and the ability to use a compass and understand how to set up a survey. Workers have to be fairly adept as far as using compasses and pacing.

Q: What about communication and writing skills—are these important for graduates?

A: Yes, graduates must be able to put their thoughts into words. For instance, regeneration exam folks have to go out and do about a week's worth of work and turn it in. We may or may not be there when they turn it in, and they need to capture their thoughts and relay them concisely in writing. We ask them to summarize their numbers, but we also ask them to write about sites—for example, what did you see out there that may influence what we

do—how do things look? I guess the first thing that comes across is penmanship. We have to be able to read field reports, first and foremost, and then the information must be put into a context that somebody who is somewhat familiar with the site can understand. That, to me, is a big problem, and it is a major weakness—all aspects of communication. Part of it is that employees need to be able to talk to and relay information to someone else, and they also need to be clear with written information that is turned in at some point after an activity is done. And we're not asking for lengthy reports—just a paragraph or two, three or four sentences. I think that more and more we're asking people to put down in writing what they're seeing out there in the field, and not being able to do this effectively really hurts the outcomes.

Q: What computer skills are needed—whether it be word processing, spreadsheets, or any other database management?

A: I think that computer skills for individual contractors—the ones who are doing planting inspections, regeneration exams, etc.—may not be quite so important as understanding what they're seeing in the field; like, "Hey, this tree is not doing well and here's why," and understanding what caused it [e.g., the damaging agent]. We have several contractors who track their results on a computer, and anyone who is going to go into the contracting business, especially when they've got somebody working for them, will need computer skills. Handheld data recorders will probably evolve into something more like a PC or a laptop that you take out in the field.

Q: What about GIS and GPS tools?

A: Forestry has had limited exposure to GPS equipment. Although GPS is much faster, and our engineers use it, the limiting factor in some cases, especially when you get into second growth stands, is that the tree canopy affects your readings [by blocking satellite communication]; but in open areas like clearcuts, I would expect to see more and more use of GPS.

Willamette Industries
Albany, Oregon
10/4/96

One-on-one Interview with Timber Management Specialist

Q: ***Is a 2-year Associate's degree sufficient to get technician work, or do graduates need a B.Sci.? What kinds of skills are you looking for in an entering employee—specifically, writing skills, math skills, sciences, forest management skills?***

A: Willamette Industries usually hires 4-year graduates. Basically, we hire very few foresters as permanent full-time employees straight out of school. We tend to have summer

positions, and we tend to hire people on a part-time basis in the summer—keying in on college sophomores and juniors, so that we can pick people after we've had them a couple of summers. While here, we can assess how they fit in with our company, and how Willamette fits in with them. While interns, we have them doing reproduction surveys, etc.—some pretty non-technical sorts of things. We do try to get them into a little bit of inventory, cruising and that sort of stuff, but there isn't a real high expectation. If someone walked in and asked me what the most important thing is for incoming employees, it's quite simply—*good work ethic—that's number one, number two, and number three on the list.* Attitude is a big part of that—*enthusiasm, youthful enthusiasm*—those are really key components. Quite frankly, we can deal with lack of ability, or lack of knowledge on some of the technical stuff, if we have that attitude and ethic. Because if we have that, we can build those other skills. Although we typically hire kids that are on a 4-year track, we do have several from 2-year programs. If students or graduates can sell themselves on the work ethic, the degree is not as important.

Q: Is job shadowing or a cooperative work program an option with Willamette Industries; if so, how might we work out an agreement?

A: We typically have not done that sort of thing in the past with Chemeketa students—our approach has been hiring summer interns. We take a fairly serious approach to providing interns with a variety of experiences. To the degree we can, we offer a variety of tasks; interns are at least to some degree "shadowing" our field foresters. But we don't have a formal job-shadowing program, and it is unlikely that we will in the foreseeable future, due to the fact that we, like many forest-based companies, have really downsized in the last decade. Our people are extremely busy, and although conceptually, a student's just going to be standing with you, it does impact on time, and we're very protective of our foresters' time. So, shadowing would be unlikely.

Q: What about skills—particularly cruising/inventory? What technology is being used? Regarding skills, what could push one potential employee past another?

A: As far as hiring, we expect technical skills to be basically understood. We expect a forester to conceptually understand inventory, cruising, estimating volumes, and have basic mathematical skills related to natural resources—for example, how big is an acre?—all those kind of standard things. But Willamette emphasizes *knowledge of basic skills*—we place high priority on providing teaching/training "in-house," and we pride ourselves in doing things "with a different flavor" than any other company in terms of this.

As far as inventory skills and technology, I am responsible for our GIS and our timber inventories, so I will answer you from that framework. It is important that, conceptually, students understand GIS. It is important that they are comfortable with sitting down with a PC and operating in a computer environment. We don't anticipate or expect at this point that we will get a person out of school who will understand ArcInfo—that's well beyond our anticipation. We, like a lot of companies, are just getting to the point where we have GIS "implemented on the ground," and we're just at the point where we're using it to its

full potential. Our field foresters have very little experience, and as we look at the utility of GIS at the field level, our approach is that those who are comfortable with it, such as the kids who came out of school in the last couple of years—that they'll be our frontrunners in using this technology which is going to define how we do things more and more in the future.

In plane surveying, it's important to conceptually understand the mechanics and broad applications of math, but "specifics" will be taught on the job. For instance, students need to understand how a survey is closed mathematically—how to do it and know the calculations involved.

Q: Is most of the inventory data put in an electronic recording device?

A: Yes—we use standard data collectors, and we have an in-house program we've written to download the data; we also have a customized inventory program. A forester doing inventory work is expected to be very comfortable collecting data on a field data recorder, transferring it into a PC, using the editor to make appropriate changes, and then going through a customized menu-driven program to get the necessary information. We don't expect technicians to be able to program, but they should understand how to use growth and yield software and others commonly used in forestry.

Q: What about communication and writing skills?

A: I would say that *communication and writing skills are probably the weakest* items I've seen from foresters, and I've often wondered why. I think it's probably a combination of two things: 1) In the past, it hasn't been stressed in the curriculum, and 2) foresters as a group tend to become foresters because they don't want to "do that stuff"—that's not their personality. I think communication and writing skills are extremely important—especially verbal communication. We, like a lot of large companies now, are dealing more and more with team and group environments, and I would say if you want your graduates to stand out, focusing on communication skills would be ideal. Just in the hiring process, good communications skill are hugely advantageous. These skills should be stressed in the technical curriculum. Even if we hire someone to work in our "back shop" in GIS, we're obviously going to expect a whole lot more as far as a basic ability to communicate well. If you get that [rare] combination of technically-skilled and communicatively-talented person, it would be very powerful.

Q: What about the idea of specialization? Does today's forester need to be specialized?

A: There is a huge distinction between our company and the Forest Service, and I can't speak for other industries, but for Willamette, I don't see the need for new employees with particular specializations, except perhaps for GIS and analysis needs. The last person we hired has a Master's degree in GIS; however, our focus has continued to be in hiring field foresters whose responsibilities have been fairly broad. We have the old "German-sort of Forestmaster" mentality. Our lead forester is a resident forester—he lives it, it's his tree

farm. Our resident foresters last forever, and the one we have with the least seniority has been with us for 15 years. They know their tree farms like the back of their hand—they love them, and they keep them up just like their own property. That has really served us well over time—they have a real pride in ownership, and it's very effective for the Company to have our resident foresters convey information to educate the public. And these residents tend to be generalists. In the last five years, however, our biggest increase in hiring has been at the specialist level (e.g., biologist, communications specialist, GIS), but I don't see this becoming a general trend.

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USDI BUREAU OF LAND MANAGEMENT
EUGENE, OREGON
10/17/96

Focus group represented by:

Timber Management (TM)
Forestry/Supervisor (F/S)
Forest Engineering/Supervisor (FE/S)
Forestry Technician (FT)

Q: When you a hire a person for technician work, is it usually a person with a 2- year or 4-year degree?

A: We usually hire people with a 2-year degree (group consensus). (There was discussion about how, historically, the Forest Service and BLM went from hiring 4-year to hiring 2-year graduates. It was noted that 2-year graduates were more likely to stay in those positions.)

Q: How do you see the employment of technicians in the BLM moving in the future?

A: FT: We haven't hired very many technicians in the last 5 years; our most recent full time hire was 2 years ago [and the technician we hired was a CWE student]. We haven't been hiring because of the downsizing of government agencies. One thing to note is the average age of BLM employees in western Oregon is 46 years old. I would predict in about five or six years, retirements are going to be very heavy. We're not sure who we might hire back, or at what level of education, but the outlook right now isn't real bright for new hires—and when I say, "right now"— I mean in the next year. In the next five years, I think the outlook will be somewhat brighter.

FE/S: We rely on the forestry techs. to do a lot of the work, and we'll need to replace those who retire. We can't do without the skills provided by the techs. Although the short term outlook isn't so great, we're hoping within a year or so to probably hire another forestry tech. in our cruising program. Currently, we feel we're kind of at the base line; i.e., if we don't replace skilled workers that are leaving, or retiring, then we're not accomplishing our necessary tasks—and I don't think that's acceptable.

Q: And how would you define what the "basic skills" are?—comment on math skills in particular.

A: FE/S: Students certainly need technical skills, but we're finding that they can often be learned on the job. When I was first hired, and I was told to do a stand exam, I was taught how to do it. Similarly, now we're going through a lot of things like teamwork training, and communication skills training—*just being able to communicate is important.* Even our forestry technicians are expected to produce written field reports. We expect the forestry techs. to take data and information, decipher it, and relay the information to the specialists. Our technicians are an integral part of planning and implementing decisions. Basically, technicians need to take a plan or a decision that's "on paper," and put it on the ground, which I think is a tremendous skill—and it's not something that just anybody can do. To do this sort of work, technicians need abilities to communicate with people, listen to them and understand them, and also have the know-how to take fairly complicated decisions/plans and translate them into on-the-ground projects.

TM: Educators cannot afford to miss teaching basic skills like communication; other basic skills in forestry include being able to measure and identify trees, and do a traverse—these are the fundamentals of what forestry is all about. I think GPS-related course work would be valuable, and we're using lasers now.

F/S: Other basic skills are those in forest surveying and basic mensuration.

TM: Students also need a computer background—part of our job is downloading Electronic Data Recorder information into a PC.

FE/S: Basic computer skills also include using PC Traverse or PC Logger.

F/S: I lacked training in computer-based skills in school (2-year forestry program). We had to do everything on paper, and when I came to the BLM, they had field recorders, computers—everything. In school, we had to work everything out by hand. In my case, I wish we had used forestry computer programs, including ArcView—when I got out of school, I had never used them—and this has put me at a disadvantage on the job.

FT: *On ArcView, and GIS programs, we call it "modernization"*—where agencies like us in the BLM are going through this process which is bringing UNIX-based ArcInfo systems to us, and upgrading our technology capability in general.

F/S: As far as math skills, basic math and trigonometry are sufficient; in my 2-year program, math classes were taught in a forestry context (e.g., we had examples using trees); these courses equipped me well.

TM: I took math beyond the requirements for forestry, and my experience was it was out of the scope of what I needed to learn.

Q: What about communication, writing and other skills?

A: F/S: In my 2-year program, I think we should have taken more than the one speech course required in the program.

TM: I don't remember taking any speech classes. We had writing classes, but I don't remember speech classes. And I feel speech classes are valuable. Learning is one thing, but getting people to understand what you want them to understand is another. I also think some sort of decision-making courses would be valuable.

F/S: In a position like mine, we usually need to communicate to only one person—perhaps to tell them what we're doing. We usually don't need to get up in front of a group and give speeches. I've communicated within our little work group, but I don't think that speech or public address skills are that important. On the other hand, I think students are going to need more computer skills. They need to be able to run LOTUS [123], and word processing systems and spreadsheets.

FE/S: Do the tech. programs have any kind of summer field trip? One of the things we run up against is that people get into this field—and then they decide they don't really like working outside. We expect employees to spend 70% of their time out in the field. Sometimes, and I see this more in foresters than forestry techs., they'll say, "I don't really like this. I got into this forestry job, but I don't know if I really like forestry." The job requires going up and down hills, in all different kinds of weather; some people love that and that's what drew them to the job, but others start saying, "I'd rather have another assignment or something that's more of an office position." (One interviewee commented: "I grew up in North Bend, Coos Bay, Oregon—and it only took me a couple of years of field work in this area to realize that I didn't want to work in that country. When you get out of the rig and you're looking for the unit, the brush is over your head, and you can barely do a cruise in there, and you're wondering, *who beat you up?—it's horrible out there!*")

TM: That's what I understood as a forestry tech.—you were going to be required to be out in the field a lot. That was your job, field work. But now, technicians are going to have to know a lot more—like computers, and other parts of the job besides field work.

FE/S: I think job shadowing works both for the future employee and the agency. (A comment was made that, "I wish I had been in a shadowing program, rather than a seasonal firefighter while going to school, because it would have prepared me better for the BLM.") Job shadowing can match up a skill with something a person wants to do, and that can be kind of an expensive mismatch if you hire someone directly from school, and you find out a couple of years down the road that you're not getting what you're hoping for—and the employee is also not happy. If I was looking at someone as a potential employee, I would really look for experience because then I wouldn't have to worry that maybe in a year or two they would decide, for instance—*cruising isn't what I want to do. I can't stand this stuff!*

Q: What about the need for basic levels of statistics?

A: F/S: You don't have to know all the mathematical calculations of statistics, because the computer does the calculations for you—but I think you do need to know what the statistics mean and how they basically work.

FE/S: You at least need a basic understanding of what's going on; employees definitely need to know what they are doing out there....

TM: Especially when you're out there deciding where your plots should be, and how you're laying them out; you at least have to know, *"this can't even be done—this would throw the sample completely out of whack."*

FE/S: I think it's important to be able to understand and speak the lingo—I mean, I hear the cruisers talking all the time about their standard error, and if you didn't have that background, you wouldn't be able to function on the job.

TM: You can't even tell if your cruise is good if you don't know [how to find the standard error.]

F/S: I think students definitely need an understanding of statistics....

FT: But the emphasis needs to be on, "What do the numbers mean?" not on, "How do you get the numbers?" So many times the profs. will say, "Figure out the standard error, the mean, add up all these numbers, and do all these calculations..." but they spend very little time explaining *what the numbers actually mean.*

F/S: I found it helpful in class to apply the numbers to forestry work by intentionally going out and physically figuring how we measure trees, etc. I suggest doing something meaningful out in the field—don't just give them numbers in the classroom.

Q: Are there any other skills—or deficiencies—that you can think of in technical education programs?

A: FE/S: We mentioned ethics, and I don't know how you would translate this into course work—but I was trying to hire a couple of forest techs. this summer, and I found out in conversations during phone interviews that in two cases [out of six acceptable applicants], that both people were uncomfortable with having trees cut down, or being involved with any activity where old growth trees were being harvested. I remember thinking, "Whoa, that's something I hadn't really thought of." Usually when you apply for a forestry tech. position, you figure you're going to be out there marking trees for cut. So I learned there was an attitude in some people who are applying for these kinds of jobs where their personal values may get in the way of what's asked of them. As an employer, you want to avoid getting new hires out there and finding out after-the-fact that these problems may

exist. We have also had a biological tech. working for us this summer who refused to help us mark retention trees in a regeneration harvest. I'm curious how they could even make the decision to work here. Because in the end, if they don't physically mark trees for harvest, then someone they work with, a co-worker, will have to do it.

FT: Also, in designing a curriculum, remember that we use forest techs. for many jobs—from cruising, to engineering, to stream surveys—we use them across the board for a multitude of things. If you think we're hiring just cruisers, or just timber layout people, that's not the case.

Referring to the need for a broad-based curriculum, I think students need something to expose them to the fact that there's something more than just trees—and it's real important. I think a general class in forest policy would also be beneficial—and when I say forest policy, I'm trying to say that it would be neat if educators had, say, Weyerhaeuser, a government agency, and Earth First [an environmental advocacy group] standing in a room all at the same time for students to interact with. We're getting to the point where we manage our forests in a very, very different way than the industrial forests—the Weyerhaeusers, the Willamette Industries. We were headed down a path that was pretty similar in many respects, but I think we're starting to diverge quite a bit in that we're managing for the public's needs. Where we are coming from now is different—it's society and public policy and how the voters feel that drive agency priorities. On the other hand, industry's doing what they do largely because of its stockholders.

Students need to be exposed to these different values that steer overall land management goals, and to know where different employers are coming from. We both [industry and BLM] manage the same kind of ground—but with very different objectives.

FE/S: I think these suggestions are good. Students should have an introduction to the fact that we have things like the Endangered Species Act and National Environmental Policy Act (NEPA). They don't have to be trained to interpret these acts, but they need to know about them, so if they get into public forestry, they understand that there is a whole realm of things that constrain us and guide us—and we have to work within these constraints. I think that forestry techs. should have a working knowledge of these guiding principles, so when they're out there implementing these actions, they don't just blindly follow what somebody tells them—they can actually go from their own understanding.

What is a DACUM?

It is an abbreviation for Developing **A CurriculUM**, an occupational analysis performed by expert workers in the field. The DACUM produces an occupational skill profile which can be used for instructional program planning, curriculum development, training materials development, and other employment-related activities.

In the case of community college curriculum development, the DACUM process would be as follows: program designers would identify a panel of about 8-12 "expert workers" from their program's field, including technicians and managers. The DACUM Panel would be convened for a day (or more), and a trained DACUM Facilitator would ask the "DACUM panel of experts" — *What skills and competencies do workers in your field need to be successful when entering the work force?* The basic assumption of the DACUM process is that expert workers are better able than anyone else to describe their occupation. The product of the DACUM panel is a chart which succinctly illustrates skills and competencies technicians need to enter the workforce. The chart is used by curriculum developers to design curriculum which includes those necessary elements defined by the expert workers.

NCSR has produced DACUM charts for each major program—Agriculture (*Resource Ecologist Technician*), Fisheries (*Natural Resources Technician*), Forestry (*Forest Resources Technology*), Geographic Information Systems (*Geographic Information Systems Specialist*), Natural Resources (*Natural Resources Technician*), and Wildlife (*Fish and Wildlife Technician*).

Center for Education and Training for Employment,
College for Education, Ohio State University

NCSR DACUM PANELISTS

Resource Ecologist Technician	Natural Resources Technician	Forest Resources Technology	Fish & Wildlife Technician	Natural Resource Technician	Forest Resources Technology	GIS Specialist
Sponsored By: Shasta College **Date:** January 12, 1996 **Panel Members:** Cathy Bartels, Farm Credit Services Sandra Dupret, Trinity County Resource Conversation District Bill Eiler, Eiler Ranches Jeanean Falletti, Turtle Bay Park and Museum Robert Frazier, USFS Stan Gorden, Shasta College Farm Mgr. Thomas Jordan, Shasta County Opportunity Ctr. Cindi Juhasz, U.S. Bureau of Reclamation Vanza Rising-Smith, California Dept. of Transportation Shelly Stoltenberg, Fall River Feed Store Roxanne Turkovich, Carter House Natural Science Museum Linda Weaver, California.. Dept. of Fish and Game/Adopt-A-Watershed	**Sponsored By:** Grays Harbor College **Date:** January 11, 1996 **Panel Members:** Randy Aho, WA Dept. of Fish and Wildlife Greg Edwards, Eco Syst. Dan Guy, WDFW Holly Jacobson, Weyerhaeuser Dan Longmire, WA Dept. Of Fish and Wildlife Norby MacMillan, Columbia Pacific Resource Cons. & Dev. Randy McIntosh, WDFW Mark Mobbs, Quinalt DNR Allen Pleus, NWIFC Tom Ross, Columbia Pacific Res. Cons. & Dev. John Todd, Weyerhaeuser Jim Walls, Columbia Pac. Resource Cons. & Dev. Lorna Wange, WDFW Mike Womer, Scan-Am Fish Farms Doug Zimmer, USFWS	**Sponsored By:** Central Oregon Comm. College **Date:** April 8, 1996 **Panel Members:** Shiela Holman, Wallowa-Whitman National Forest JoAnne Hanney, Bureau of Land Management Andy Coray, Deschutes National Forest Dave Pitts, Forestry Consultant/Logging Contractor Mark White, Mason, Bruce & Girard Jerry Orr, Confederated Tribes of Warm Springs Brian Wilkinson, Logging Engineering International Lyle Klenski, Malheur NF Janice Madden, Deschutes National Forest Bob Parker, Crown Pacific Corporation Jill Williams, Bureau of Land Management Lisa Rynearson, Malheur National Forest John Jackson, Oregon Dept. of Forestry	**Sponsored By:** Feather River College **Date:** November 6, 1996 **Panel Members:** Dennis Chester, U.S. Forest Service Clay Clifton, U.S. Forest Service Charlotte Coultier, U.S. Forest Service Jan Dawson, California Dept. of Fish and Game Ron Decoto, California Dept. of Fish and Game Syd Kahre, California Dept. of Fish and Game Pamela McKinnon, U.S. Forest Service Bill Peters, California Dept. of Fish and Game Gary Rotta, U.S. Forest Service Tricia York, U.S. Forest Service	**Sponsored By:** Western Ctr. For CC Development **Date:** December 4, 1997 **Panel Members:** Gary Galovich, Oregon Department of Fish and Wildlife Scott Hopkins, Bureau of Land Management Rob Wessberg, Willamette Mission State Park Tom Worcester, Fisheries, Mt. Hood Community College Hank Wujcik, Salem Public Works Department	**Sponsored By:** Chemeketa Comm. Coll. **Date:** October 31, 1996 **Panel Members:** Dennis Creel, Hampton Tree Farms Terry Fennell, USDI Bureau of Land Management Tom Vanderhoof, Bureau of Land Management Darrel Foster, Bureau of Land Management Mo Jeffries, USDA Forest Service Dan Johnson, Siuslaw National Forest Al Tocchini, Oregon Dept. Of Parks & Recreation Dean Berg, Silvicultural Engineering	**Sponsored By:** Grays Harbor College **Date:** April 22, 1997 **Panel Members:** Kyle Bastrup, Grays Harbor Co. Centr. Srvs. Michael Bishopp, Pacific Co. Public Works Dept David Caudill, WDFW Robin Nelson, Pacific Co. Public Works Dept. Joan Persinger, Weyerhaeuser Company Don Saul, WDFW Mark G. Scott, The Willapa Alliance Mike Stamon, Quinault DNR Kim Taylor, Northwest Indian Fisheries Comm. Tim Triesch, Grays Harbor Regional Planning Commission Andy Wilson, Rayonier Inc. Angie Wollen, GHC Centr. Srvs.

FISH AND WILDLIFE TECHNICIAN

TASKS →

DUTIES ↓

A. Understand Fish and Wildlife and Their Ecosystems	A1 Perform habitat improvement	A2 Possess knowledge of plants *	A3 Possess knowledge of wildlife *	A4 Possess knowledge of current environmental issues	A5 Access research
	A6 Use and implement scientific method	A7 Understand marine resources	A8 Know organizational goals		
B. Skills Training	B1 Restrain wildlife	B2 Understand and apply fish and wildlife laws/regulations	B3 Rehabilitate wildlife	B4 Inventory, monitor, and survey wildlife, fish and habitat	B5 Use/implement scientific method
	B6 Perform habitat improvement	B7 Practice wildlife safety	B8 Assist in basic veterinary and drug techniques	B9 Access research	B10 Practice fish culture
	B11 Use radio telemetry				
C. Perform Fish and Wildlife Resource Assessment	C1 Use/implement scientific method	C2 Perform project interpretation and follow-through	C3 Perform map and compass work	C4 Interpret and gather data	C5 Access research
	C6 Interpret maps	C7 Use GIS and GPS	C8 Read aerial photos		

DACUM Project: Fish & Wildlife Technician

Sponsored By: Feather River College/NCSR

Date: November 6, 1996

Data Coordinator: Jay Wright

Data Facilitator: Michael Welser

Panel Members:
Dennis Chester, U.S. Forest Service
Clay Clifton, U.S. Forest Service
Charlotte Coultier, U.S. Forest Service
Jan Dawson, California Dept. of Fish and Game
Ron Decoto, California Dept. of Fish and Game
Syd Kahre, California Dept. of Fish and Game
Pamela McKinnon, U.S. Forest Service
Bill Peters, California Dept. of Fish and Game
Gary Rotta, U.S. Forest Service
Tricia York, U.S. Forest Service

* See Appendix

D. Utilize Communication Skills	D1 Possess basic understanding of sociology	D2 Write literate technical reports	D3 Practice people skills	D4 Understand and cope with supervisors	D5 Perform project interpretation and follow-through	D6 Conduct tours	D7 Demonstrate public contact skills
	D8 Use basic supervisory skills	D9 Conduct public presentations	D10 Perform interagency communication	D11 Conduct meetings	D12 Possess interpretive skills		
E. Maintain Job Safety	E1 Perform first aid and CPR	E2 Possess survival skills	E3 Practice 2-way radio skills	E4 Practice safety techniques with all equipment	E5 Practice wildlife safety	E6 Maintain physical fitness	E7 Assess dangerous situations
	E8 Practice fire safety						
F. Demonstrate Professionalism	F1 Use common sense	F2 Accept and give criticism (feedback)	F3 Possess time management skills	F4 Practice self-motivation	F5 Perform project interpretation and follow-through	F6 Use basic supervisory skills	F7 Practice teamwork
	F8 Conduct meetings	F9 Know organizational goals	F10 Perform individual tasks	F11 Maintain positive attitude			
G. Operate a Computer	G1 Possess basic computer skills	G2 Perform word processing	G3 Operate a relational database	G4 Operate GIS program	G5 Access/send E-mail	G6 Access Internet	G7 Perform statistical analysis
	G8 Gather and interpret data	G9 Enter data					
H. Maintain and Operate Equipment	H1 Operate vehicles *	H2 Assess dangerous situations	H3 Practice 2-way radio skills	H4 Operate watercraft *	H5 Demonstrate firearm use	H6 Use pack stock	H7 Maintain vehicles
	H8 Operate equipment *						

*** See Appendix**

I. Perform Non-Fish/ Wildlife Skills	I1 Possess basic accounting skills	I2 Possess basic farming skills	I3 Possess job interview and application skills	I4 Practice 2-way radio skills	I5 Apply basic construction skills *	I6 Maintain physical fitness	I7 Perform basic math skills *
	I8 Possess business/contract skills	I9 Possess basic science skills *					

APPENDIX

A2-Knowledge of plants:
Taxonomy
Physiology
Species
Dendrology
Botany
Aquatic
Habitat

A3-Knowledge of wildlife:
Habitat
Behavior
Birds
Mammals
Amphibians/reptiles
Insects
Invertebrates
Fish

H1-Operate vehicles:
4-wheel drive pickup
Snowmobile
ATV
Heavy equipment

H4-Operate watercraft:
Kayak
Jet ski
Canoe
Raft
Electrofishing boat
Motorboat

H8-Operate equipment:
Field compass
Binoculars
Staff compass and rod
Clinometer, densiometer, Relascope
Auger, posthole digger, Comealong
Hand tools: McCloud, Polaski, shovel, axe, hammer, extension ladder
Fencing materials: barbed wire
Camera equipment
Tape recorders, power horn
Solar pathfinder
Spotting scope
Microscope (dissecting)

H8-Operate equipment:
Chainsaw
Pigmy meter
Hatch kit
Pack horse gear
Transit
Carpentry tools
Electroshocker
Fish nets
Aerator
Various measuring devices
Electric/manual flow meters
Soil percolation testing (compaction)
Hip chain
Radio Telemetry equipment
Stereoscope for aerial photos
DBH tape
Water sampling equipment
Transmitter/receiver
Data collector
Trailmaster 110m and 35mm

I5-Apply basic construction skills:
Plumbing
Electrical
Fencing
Concrete
Carpentry

I7-Perform basic math skills:
Addition, subtraction, multiplication, division
Algebra
Geometry
Trigonometry
Statistics

I9-Possess basic science skills:
Chemistry
Biology
Zoology
Ecology
Geology
Hydrology

*** See Appendix**

FOREST RESOURCES TECHNOLOGY

TASKS →

DUTIES ↓

A. Demonstrate Professionalism	A1 Keep accurate records a. data recording b. data and info management	A2 Pay attention to details	A3 Complete paperwork accurately	A4 Follow directions; perform assigned tasks satisfactorily and on time	A5 Meet deadlines
	A6 Speak and listen effectively	A7 Work effectively with client	A8 Achieve and maintain high level of physical fitness	A9 Be objective; avoid interjecting personal bias	A10 Work independently
	A11 Maintain professional skills and knowledge	A12 Participate in continuing education a. workshops b. short courses	A13 Stay current with advancing tehnology	A14 Maintain assigned equipment	A15 Practice/master stress management
	A16 Make decisions	A17 Respect management	A18 Demonstrate personal responsibility	A19 Be personally accountable	A20 Practice good work ethic
	A21 Be self motivated; a self starter	A22 Be flexible; accept change	A23 Practice good time management	A24 Practice work planning	A25 Prioritize tasks
	A26 Be an effective trainer/instructor	A27 Recognize and consider conflicting issues	A28 Work effectively with other organizations and agencies	A29 Exercise initiative within organizational structure	A30 Promote and support organization's mission/goals
	A31 Participate in professional associations	A32 Develop goals	A33 Implement goals	A34 Evaluate goals	A35 Apply organizational skills
	A36 Anticipate organization's needs and problems	A37 Visualize final product during planning	A38 Assume responsibility for administrative duties *	A39 Market self to administrators and public	A40 Understand and explain scope of services offered by organization

DACUM Project: Forest Resources Technology

Sponsored By: Central Oregon Comm. College/ NCSR

Date: April 8, 1996

Data Facilitator: Ron Wheadon

Panel Members:
Shiela Holman, Wallowa-Whitman National Forest
JoAnne Hanney, Bureau of Land Management
Andy Coray, Deschutes National Forest
Dave Pitts, Forestry Consultant/Logging Contractor
Mark White, Mason, Bruce & Girard
Jerry Orr, Confederated Tribes of Warm Springs
Brian Wilkinson, Logging Engineering International
Lyle Klenski, Malheur National Forest
Janice Madden, Deschutes National Forest
Bob Parker, Crown Pacific Corporation
Jill Williams, Bureau of Land Management
Lisa Rynearson, Malheur National Forest
John Jackson, Oregon Dept. of Forestry

*** See Appendix**

A. (continued)	A41 Understand and explain scope of services offered by sister agencies	A42 Find relevant information - references, literature, documents	A43 Analyze and interpret data	A44 Practice communication skills *	A45 Apply supervisory skills *		
B. Apply Technical Skills of the Profession	B1 Measure cruise/scale timber	B2 Conduct natural resource surveys *	B3 Conduct physical land surveys *	B4 Employ orienteering skills using topographic maps and aerial photos.	B5 Utilize/interpret aerial photos and topographic maps.	B6 Process multispectral satellite imagery.	B7 Utilize "tools" *
	B8 Use field data recoder *	B9 Utilize Global Positioning System technology *	B10 Utilize Geographical Information System technology *	B11 Utilize keys and other references to identify *	B12 Employ computer skills in *	B13 Convert data among various measurement systems (English, metric, etc.)	B14 Safely operate machinery *
	B15 Apply sampling statistics to data.	B16 Design cruise/ sampling projects	B17 Apply math skills *	B18 Evaluate conditions that affect fire behavior and occurrence.	B19 Perform basic fire fighting skills	B20 Plan/layout timber marking unit	B21 Perform harvest system analysis
	B22 Design unit-level harvest plan	B23 Design biomass handling plan	B24 Plant trees	B25 Write long-term harvest schedule	B26 Work with contracts a. prepare b. administer	B27 Run and interpret growth and yield models	B28 Perform quality assurance checks
	B29 Apply timber theft prevention measures	B30 Manage special products—mushrooms, firewood, etc.	B31 Collect and handle seeds of non-tree species (revegetation projects)	B32 Implement multiple resource management system	B33 Practice safety		
C. Practice Effective Interpersonal Skills	C1 Be a team player	C2 Respect diverse viewpoints	C3 Respect cultural differences	C4 Defuse hostile/dangerous situations	C5 Work effectively with distraught persons	C6 Communicate effectively with colleagues	
D. Apply Business Management Principles to Natural Resource Management	D1 Practice business aspects of the profession	D2 Recognize and integrate economic considerations	D3 Support economic decisions	D4 Conduct cost analysis *	D5 Manage budget	D6 Market/advertise services	D7 Provide customer services

*** See Appendix**

D. (continued)	D8 Write bids/proposals	D9 Be financially responsible with purchases, etc.	D10 Relate to path of raw materials through manufacturing to product(s)	D11 Administer financial aspects of contracts (e.g. payments)			
E. Abide by Policies and Rules	E1 Comply with regulations	E2 Explain state and federal regulations	E3 Be aware of authority and limitations	E4 Be aware of conflicting policies and rules			

APPENDIX

A38-Administrative duties:
Travel
Time
Costs, etc.

A44-Communication skills:
Use telephone and radio correctly
Communicate effectively with the public
Report on field work
Write technical reports
Utilize natural resource vocabulary/ glossary
Utilize taxonomic nomenclature for all classes of plants
Write an effective resume

A45-Supervisory skills:
Apply personnel management principles
Explain hiring policy and procedures
Promote safe working practices
Supervise and manage people
Conduct performance evaluations
Communicate effective with subordinates
  Give clear instructions
  Assign tasks
Conduct employment interview
Resolve grievances

B2-Conduct natural resource surveys:
Stand exam
Reproduction (seedling) stocking
Fuel loading
Range condition/forage
Botanical
Plant communities and associations
Archeological
Threatened & endangered (T&E)
Stream/fish
Insects/disease

B3-Conduct physical land surveys:
Unit traverse
Road location and layout
Property lines
Skyline profile
Hand compass
Staff compass
Pacing
String box

B7-Utilize tools:
Clinometer
Relaskop
Range finder
Tape recorder
Camera
  Video
  Still

B8-Use field data recorder:
Program recorder
Enter data
Download data to computer

B9-Utilize Global Positioning:
Operate equipment
Download data to computer
Differentially correct readings
Upload to graphics/mapping software

B10-Utilize Geographical Information System technology:
Create data layers
Apply models
Produce maps

B11-Utilize keys and other references to identify:
Plants
Grasses
Plant associations and communities
Wildlife
Insects

B12-Employ computer skills in:
Word processing
Data bases
Spreadsheets
Drafting (CADD)
Geographical information systems (GIS)
Global positioning systems (GPS)

B14-Safely Operate machinery:
Chain saw
Hand tools
Pumps
All terrain vehicle
Snow mobile
Fork lift
Bulldozer
4-wheel drive vehicle
Manual shift vehicle
Mountain bike

B17-Apply math skills:
Geometry
Right triangle trigonomic functions
Unit circle
Algebra
Formulae

D4-Conduct cost analysis:
Benefit/cost ratio
Present net value
Future net value
Time value of money
Sinking fund
Depreciation
Capitalization

*** See Appendix**

FOREST RESOURCES TECHNOLOGY

TASKS →

DUTIES ↓

A. Be Competent in Scaling and Cruising	A1 Be able to take basic measurements	A2 Identify plants, trees and wood types	A3 Use and care of tools of the trade*	A4 Ability to read a map	A5 Be aware of the different methods of cruising
	A6 Interpret aerial photos	A7 Identify grades of logs	A8 Identify forest diseases and forest insects	A9 Identify high and low value timber	A10 Compute timber volumes and economic values
	A11 Write technical reports	A12 Administer a basic contract	A13 Comply with regulations		
B. Competency in Surveying and Mapping	B1 Be aware of land measurement systems	B2 Operate equipment, use and care for tools of the trade*	B3 Identify property lines and corners	B4 Access county land records	B5 Read topographical maps
	B6 Be aware of land measurement systems*	B7 Identify land ownership	B8 Draft maps (including computer generated maps)	B9 Knowledge of GIS (Geographic Information Systems)	B10 Be competent in computer skills
	B11 Identify correct property locations	B12 Write technical reports	B13 Comply with safe practices	B14 Administer a basic contract	B15 Comply with regulations
C. Take Inventory of Resources	C1 Recognize plant communities	C2 Be aware of ecosystem structure and function	C3 Be aware of the principles of ecology	C4 Use computers and data recorders	C5 Design effective measurement systems
	C6 Interpret contracts	C7 Recognize soil/physical qualities of landscape	C8 Recognize noxious weeds	C9 Collect data for watershed analysis	C10 Be aware of basic science principles*
	C11 Write technical reports	C12 Administer a basic contract	C13 Comply with regulations	C14 Read topographical maps	C15 Use and care for tools of the trade*

DACUM Project: Forest Resources Technology

Sponsored By: Chemeketa Community College/ NCSR

Date: October 31, 1996

Data Facilitator: Ara Andrea

Panel Members:
Dennis Creel, Hampton Tree Farms
Terry Fennell, Bureau of Land Management
Tom Vanderhoof, Bureau of Land Management
Darrel Foster, Bureau of Land Management
Mo Jeffries, USDA Forest Service
Dan Johnson, Siuslaw National Forest
Al Tocchini, Oregon Dept. of Parks & Recreation
Dean Berg, Silvicultural Engineering

*** See Appendix**

D. Be Competent in Engineering Systems	D1 Be able to read maps	D2 Comprehend array of harvesting systems	D3 Comprehend transportation systems	D4 Be aware of the various uses of equipment and costs	D5 Calculate payload limits	D6 Design and lay out harvest systems	D7 Design a road
	D8 Understand basic hydrology	D9 Be aware of yarding and loading timber processes	D10 Be aware of felling and bucking principles	D11 Be aware of the uses of rocks and other road building materials	D12 Write a basic contract	D13 Administer a basic contract	D14 Comply with regulations
	D15 Read soil conservation maps	D16 Distinguish between how regulations relate and don't relate	D17 Monitor the impact on the environment	D18 Convert from metric to standard measurement	D19 Stay within legal limits of contract law	D20 Recognize unstable soil conditions (roads)	D21 Obliterate roads
	D22 Maintain roads	D23 Comprehend basic principles of forest economics	D24 Write technical reports	D25 Use and care for tools of the trade*	D26 Administer a basic contract	D27 Comply with regulations	
E. Be Competent in Computer Skills	E1 Perform adequate keyboard skills	E2 Perform data entry	E3 Use word processing and spread sheets	E4 Use data tables	E5 Manage files	E6 Be aware of computer terminology	E7 Use data recorders
	E8 Use GIS software						
F. Demonstrate Professionalism	F1 Exhibit good attitudes	F2 Be aware of basic supervisory skills	F3 Be able to work as a team member	F4 Get along with other people	F5 Demonstrate good judgement	F6 Demonstrate good public relations and customer service skills	F7 Comply with professional and work ethics
	F8 Listen for instructions and information	F9 Write technical reports					
G. Be Competent in Silviculture	G1 Manage the landscape	G2 Be aware of silviculture systems	G3 Be able to develop goals	G4 Take inventory (stand exam)	G5 Recognize diseases of trees	G6 Take precise measurements on the stand plot	G7 Analyze data related to goals
	G8 Present information	G9 Implement the decision	G10 Be aware of techniques of silviculture*	G11 Be aware of nursery options	G12 Perform tree planting	G13 Be aware of young stand manipulations	G14 Recognize importance of soils

*** See Appendix**

G. (continued)	G15 Write technical reports	G16 Administer a basic contract	G17 Comply with regulations	G18 Read topographical maps	G19 Use and care for tools of the trade*		
H. Comply with Safe Practices	H1 Recognize and evaluate hazardous situations	H2 Put chains on a vehicle	H3 Perform CPR/Survival training	H4 Perform basic outdoors/survival skills	H5 Comply with OSHA regulations	H6 Be aware of dangerous situations	
I. Perform Basic Firefighting Skills	I1 Run, maintain, and repair firefighting equipment	I2 Obtain a CDL	I3 Be competent in ICS				

APPENDIX

A3-Use and care of tools:
Compass
Map
Rangefinder
Laser tools (criterion)
Diameter tape
Scale stick
Biltmore stick
Increment borer
Data recorder
Tape measure
Relaskop
Logger's tape
Prisms
Clinometer

B2-Use and care of tools:
Data recorder
Pocket compass
Staff compass
Transit
Theodolite
Clinometer
Tape (cloth and steel)
EDMI (Electronic Distance-Measuring Instruments)

B6-Land measurement systems:
Latitudes and departures
Metes and bounds
Rectangular grid system
Township
Range and sections

C10-Basic science principles:
Biology (wildlife and fish)
Hydrology
Environmental Science
Soils
Geology

C15-Use and care of tools:
Compass
Map
Rangefinder
Laser tools (criterion)
Diameter tape
Scale stick
Biltmore stick
Increment borer
Data recorder
Tape measure
Relaskop
Logger's tape
Prisms
Clinometer

D25-Use and care of tools:
Data recorder
Pocket compass
Staff compass
Transit
Theodelite
Clinometer
Tape (cloth and steel)
EDMI (Electronic Distance-Measuring Instruments)

G10-Techniques of silviculture:
Tree planting
Site prep
Mechanics
Chemistry
Safety
Slash burning
Awareness of Forest Practices Act
Thinning
Spacing
Animal contact
State and federal regulations
Wildlife considerations
Woody debris
Stream needs
Planting methods

G19-Use and care of tools:
Compass
Map
Rangefinder
Laser tools (criterion)
Diameter tape
Scale stick
Biltmore stick
Increment borer
Data recorder
Tape measure
Relaskop
Logger's tape
Prisms
Clinometer

*** See Appendix**

GEOGRAPHIC INFORMATION SYSTEM (GIS) SPECIALIST: A scientifically trained, multi-disciplined individual who applies sophisticated computer hardware and software to collect, store, retrieve, process and present geographic information.

Shaded box indicates that the task applies to more than one duty

TASKS

DUTIES

A. Data acquisition and development	A1 Determine data needs/format	A2 Determine hardware/software requirements and constraints	A3 Evaluate sources	A4 Contact data originator for acquisition	A5 Assess acquisition/costs
	A6 Coordinate geodetic control prior to mapping	A7 Capture spatial and attribute data	A8 Conversion of digital formats-data abstraction (cut, simplify, stretch, and fit)	A9 Integrate data from various sources into consistent format	A10 Verify content and spatial accuracies
	A11 Create metadata	A12 Let users know that data is available			
B. Maintain and update data	B1 Establish the data custodianships	B2 Assess maintenance and update cost	B3 Develop a data maintenance schedule	B4 Gather data for updates	B5 Perform spatial and content updates
	B6 Verify that updates are error free	B7 Let users and data custodians know that updates are completed			
C. Paper mapping design and development	C1 Define purpose and use of maps	C2 Design layout	C3 Determine appropriate scale	C4 Determine appropriate fonts and colors	C5 Recognize cartographic conventions
	C6 Select proper media/output device	C7 Acknowledge contributors	C8 Maintain inventory of supplies		
D. GIS and remote sensing analysis	D1 Communicate with peers	D2 Determine appropriate projections	D3 Geo-reference imagery	D4 Classify remote sensing data	D5 Develop orthophotography

DACUM Project: GIS Specialist

Sponsored By: Grays Harbor College/NCSR

Date: April 22, 1997

Data Coordinator: Don Samuelson

Data Facilitator: Krista Mahan

Data Recorder: Fred Wood

Panel Members:
Kyle Bastrup, Grays Harbor Co. Central Services
Michael Bishopp, Pacific Co. Public Works Dept
David Caudill, WA Dept. of Fish and Wildlife
Robin Nelson, Pacific Co. Public Works Dept.
Joan Persinger, Weyerhaeuser Company
Don Saul, WA Dept. of Fish and Wildlife
Mark G. Scott, The Willapa Alliance
Mike Stamon, Quinault Dept. of Natural Resources
Kim Taylor, Northwest Indian Fisheries Commission
Tim Triesch, Grays Harbor Regional Planning Commission
Andy Wilson, Rayonier Inc.
Angie Wollen, Grays Harbor College Central Services

). continued)	D6 Perform spatial database queries	D7 Perform vector/raster overlay analysis	D8 Perform statistical analysis	D9 Perform buffer analysis	D10 Perform network analysis (dynamic segmentation)	D11 Report results	
E. Application development	E1 Assess client needs	E2 Develop applications to simplify and/or standardize procedures	E2a Determine programming tools required to develop applications	E2b Test application performance	E3 Design application	E4 Exercise quality control	E5 Support application
	E6 Update and maintain application						
F. Document data	F1 Assess client needs	F2 Produce in-house standardized data documentation	F3 Disseminate documentation where appropriate	F4 Document spatial and content changes			
G. Database design	G1 Communicate with other database managers/users	G2 Determine coverages to be managed	G3 Select database software according to: performance, usability, cost, manageability, uses, output format,...	G4 Assist in defining deliverables (maps, reports,...)	G5 Determine data consistencies	G6 Define database tables	G7 Define key fields
	G8 Create data dictionary						
H. Information sharing data exchange	H1 Develop policy for sharing data	H2 Adhere to policies for sharing and receiving data	H3 Export data in transferable format	H4 Import data into existing GIS	H5 Verify accuracy of imported data		
I. Training and education	I1 Assess level of user's knowledge and needs; train accordingly	I2 Provide information presentations for users	I3 Develop user guides	I4 Establish and maintain remote training sites	I5 Develop training applications and course materials	I6 Provide post-training support	I7 Disseminate information through a WEB site
	I8 Promote GIS uses						
J. Project management	J1 Determine scope of project	J2 Define deliverables	J3 Determine resource needs (equipment, personnel, data)	J4 Conform to policy and standards	J5 Determine future uses for completed project data/processes	J6 Develop project timetables	J7 Assess project costs

J. (continued)	J8 Budget project	J9 Allocate internal/external resource needs (equipment, personnel, and data)	J10 Coordinate multiple projects and on-going activities	J11 Monitor project progress	J12 Verify that project goals were met	J13 Maintain project resources (equipment, personnel, data)	
K. System administration; hardware/ software integration	K1 Evaluate user needs	K2 Select system design	K3 Design/implement database back-up procedures	K4 Troubleshoot hardware/software problems	K5 Optimize system performance	K6 Schedule multi-tasking of equipment	K7 Maintain systems security
	K8 Maintain peripheral compatability	K9 Maintain compatibility between system components	K10 Maintain network system	K11 Perform file management	K12 Ensure continuous software upgrades	K13 Procure new technologies	K14 Comply with software licensing agreements
	K15 Maintain hardware maintenance agreements						

MORE KNOWLEDGE AND SKILLS

Knowledge:
Forestry Basics/Survey
Fisheries
Wildlife
Geology
Geography
- Cartography
- Urban planning
- Census
- Remote Sensing
- Photogrammetry
- Transportation
- Competency in software navigation/trouble shooting

Engineering
- Surveying
- Cogo
- CAD

Computer Science
- Information Management
- Database Design

Statistics

Equipment:
CD-ROM unit
Date recorders
Digitizer
GIS software
GPS software
Modem
Operating systems-work stations
Plotters
Printers
Scanners
Storage device
Surveying equipment
Transferable media

Skills:
Operating systems
Digital file management
Networking systems
Research technical support
Jargon
Platform shop talk
Understand national documentation
Standards

Concerns and Future Trends:
Instantaneous remote sensing
Data overload
Interactive distribution of data via Internet
Despecialization (making GIS too generalized)
Integration between GPS and GIS
Open systems

Work Behaviors:
Analytical
Attitude
Communication skills
Detail oriented
Diversified tasks - time management
Devine - all knowing
Independent worker
Motivated
Organized
Positive attitude
Problem solving skills
Reliable - Punctual
Self-starter
Team player

NATURAL RESOURCES TECHNICIAN: A scientifically trained, multi-disciplined individual who applies a variety of skills which facilitate sound natural resource management.

Shaded box indicates that the task applies to more than one duty

TASKS →

DUTIES ↓

A. Scientific Training	A1 Develop basic math skills, i.e., divide, multiply, add and subtract	A2 Understand basic statistics	A3 Develop a background in natural and physical sciences	A4 Ability to use scientific methods and terminology	A5 Identify flora and fauna species
	A6 Identify fish and wildlife; historic relevance	A7 Knowledge of historic relevance of past practices	A8 Ability to research information	A9 Utilize and understand scientific and mathematical modeling	A10 Integrate principles of natural resource management
	A11 Knowledge of principles of natural resource economics	A12 Identify diseases			
B. Skills Training	B1 Ability to use First Aid and C.P.R.	B2 Practice safe operation and survival skills	B3 Perform calibration procedures	B4 Receive equipment training	B5 Use of basic trade skills
	B6 Possess boat handling and seamanship skills	B7 Receive sensitivity training	B8 Use of material safety data sheets	B9 Maintain special licenses (pesticides, CDL)	B10 Gain an understanding of fire behavior
	B11 Receive facilitation training	B12 Ability to write grants, be aware of propriety	B13 Possess basic media skills	B14 Operate electronic hand-held data recorders	B15 Use equipment manuals
	B16 Ability to speak on two-way radio	B17 Operate a computer (computer literacy)	B18 Writing skills (reports, articles)	B19 Operate standard office equipment	B20 Develop public speaking skills

DACUM Project: Natural Resources Technician

Sponsored By: Grays Harbor College/NCSR

Date: January 10 & 11, 1996

Data Coordinator: Don Samuelson

Data Facilitator: Robert S. Clark

Data Recorder: Sheila Pebles

Panel Members:
Randy Aho, WA Dept. of Fish and Wildlife
Greg Edwards, Eco Systems
Dan Guy, WA Dept. of Fish and Wildlife
Holly Jacobson, Weyerhaeuser Company
Dan Longmire, WA Dept. Of Fish and Wildlife
Norby MacMillan, Columbia Pacific Resource Conservation and Development
Randy McIntosh, WA Dept. of Fish and Wildlife
Mark Mobbs, Quinault Dept. of Natural Resources-Timber, Fish and Wildlife
Allen Pleus, NWIFC
Tom Ross, Columbia Pacific Resource Conservation and Development
John Todd, Weyerhaeuser Company
Jim Walls, Columbia Pacific Resource Conservation and Development
Lorna Wange, WA Dept. of Fish and Wildlife
Mike Womer, Scan-Am Fish Farms
Doug Zimmer, U.S. Fish and Wildlife Service

C. Data Collection Analysis	C1 Use common sense	C2 Write good field notes	C3 Consult with statistician	C4 Design and conduct pilot studies	C5 Create sample design	C6 Establish baseline conditions	C7 Prepare for data collection
	C8 Collect accurate/legible data	C9 Monitor quality of data collection	C10 Maintain sampling protocol	C11 Conduct quality control (replicate surveys, etc.)	C12 Create a data tracking check list	C13 Create a data base	C14 Create a data management system
	C15 Enter data into computer accurately	C16 Create a backup file	C17 Check for errors	C18 Correct errors	C19 Organize data for accessibility	C20 Check analysis against hypothesis	C21 Interpret and apply results
	C22 Determine relevance of data	C23 Write a report	C24 Report findings	C25 Provide suggestions for improvement	C26 Observe/safeguard confidentiality and proprietary information	C27 Integrate principles of timber, fish and water management	C28 Archive data
D. Field Work	D1 Work independently	D2 Identify fish, plant, and wildlife species	D3 Read and interpret maps and photos	D4 Perform surveys (environmental, stream, upslope, in stream)	D5 Acquire trespass authorization	D6 Accurately locate sample site	D7 Operate a computer
	D8 Check precision of instruments	D9 Know equipment (logistics)	D10 Operate equipment	D11 Maintain equipment	D12 Understanding of permit process	D13 Possess regulatory process familiarity	D14 Participate in multi-interest review of projects
	D15 Practice public relations with land owners	D16 Develop a quality assurance plan	D17 Conduct water quality sampling	D18 Conduct biological sampling	D19 Sample fish and wildlife harvests	D20 Interpret and apply information to field work	D21 Implement habitat restoration projects (fish, wildlife, plants)
	D22 Apply bio-engineering techniques	D23 Delineate ecologically sensitive areas (RM2)	D24 Observe need for forest road maintenance	D25 Maintenance of forest roads	D26 Calculate tree density	D27 Perform timber cruise	D28 Mark boundaries
	D29 Perform post-logging utilization survey	D30 Propagate plants	D31 Grow and manage fish stocks	D32 Perform remote site spawning	D33 Work with and understand hatchery practices	D34 Maintain water supply	D35 Perform facility maintenance
	D36 Use test equipment	D37 Make decisions in the field	D38 Know when to call a professional/ specialist	D39 Apply prescriptions			

E. Teamwork	E1 Know "Together Everyone Accomplishes More" (TEAM) approach	E2 Respect others	E3 Communicate	E4 Support objectives of job, project, etc.	E5 Contribute to team effectiveness	E6 Work as a team member	E7 Accomplish fair share of project
	E8 Work as a team member	E9 Develop leadership skills	E10 Encourage input/involvement	E11 Have fun!			
F. Communication	F1 Basic understanding of English language	F2 Ability to use English language	F3 Apply listening skills	F4 Practice basic manners	F5 Practice telephone protocol	F6 Practice interpersonal skills	F7 Create a safe environment for discussion
	F8 Acknowledge limits of responsibility	F9 Understand and use chain of command	F10 Use appropriate channels (methods) of communication	F11 Develop clear goals/objectives	F12 Clarify set goals	F13 Apply positive reinforcement when applicable	F14 Practice constructive criticism
	F15 Define problems and offer solutions	F16 Practice critical thinking	F17 Possess a sense of humor	F18 Use two-way communication	F19 Convey mistakes and problems	F20 Maintain documentation	F21 Ask questions
	F22 Maintain a positive attitude	F23 Possess job appreciation	F24 Interpret scientific data into lay terms	F25 Ability to speak in front of a group	F26 Ability to be a salesperson	F27 Provide training to others	
G. Office Management	G1 Follow agency or company policy/procedure	G2 Be aware of and use organizational resources	G3 Possess time management/ organizational skills	G4 Possess conflict resolution and negotiation skills	G5 Practice empathy	G6 Display keyboarding skills	G7 Create and maintain a file system (paper and computer)
	G8 Ability to use/learn word processing, spread sheet, and data base software	G9 Ability to use/learn specialized software	G10 Develop and track budgets				
H. Career Planning	H1 Possess awareness of job market	H2 Examine market opportunities	H3 Possess political awareness	H4 Appreciate structure of funding source	H5 Overview of existing agencies	H6 Develop entrepreneurial skills	H7 Develop job search skills
	H8 Continue education						

I. Professionalism	I1 Maintain professionalism (dress, appearance, language, hygiene)	I2 Exhibit common courtesy/positive work ethic	I3 Interpersonal skills	I4 Maintain team spirit	I5 Observe/safeguard confidentiality and proprietary information	I6 Practice positive sensitivity in regards to cultural awareness (ethic, gender, racial)	I7 Possess a knowledge and understanding of tribal history and issues
	I8 Respect other agencies	I9 Respect social and political position of others	I10 Possess and develop leadership skills	I11 Continue personal growth			
J. Public Relations	J1 Be honest	J2 Avoid jargon	J3 Be aware of own/agency limitations	J4 Be aware of applicable laws/rules that govern agencies	J5 Communicate policies and/or procedures to the public	J6 Be aware of the impact of actions	J7 Recognize $$$ consequence of actions
	J8 Be aware of people represented	J9 Report back to supervisor contacts	J10 Recognize a developing problem to a supervisor	J11 Know when to call a professional/ specialist	J12 Be an ambassador	J13 Use conflict management	J14 Involve public
	J15 Make public presentations						

NATURAL RESOURCES TECHNICIAN: A scientifically trained, multi-disciplined individual who applies a variety of skills which facilitate sound natural resource management.

TASKS →

DUTIES ↓

A. Habitat Management	A1 Collect water samples	A2 Collect soil samples	A3 Perform stream survey	A4 Design & layout of extractive processes	A5 Design monitoring projects
	A6 Monitor extractive processes	A7 Conduct habitat restoration projects	A8 Conduct habitat surveys	A9 Ensure regulatory conformance	A10 Assess impacts of land use
	A11 Conduct vegetation survey	A12 Maintain equipment	A13 Prepare sample for testing	A14 Analyze collected samples	A15 Collect vegetation samples
B. Manage Fish & Wildlife	B1 Review fish and wildlife restoration projects	B2 Conduct fish culture activities	B3 Collect water samples	B4 Maintain access for consumptive/non-consumptive use	B5 Insure regulatory conformance
	B6 Maintain facilities such as fish ladders & passages	B7 Construct facilities	B8 Design monitoring projects	B9 Conduct invertebrate surveys	B10 Conduct wildlife culture activities
	B11 Conduct wildlife surveys	B12 Maintain equipment	B13 Conduct fish surveys		
C. Data Management	C1 Enter data	C2 Edit data	C3 Analyze data	C4 Summarize data	C5 Catalog data
	C6 Report data	C7 Use GIS application			
D. Preserve & Protect Sites	D1 Collect historical data	D2 Conduct habitat protection projects	D3 Restore resource function	D4 Preserve resource condition	D5 Preserve aesthetics

DACUM Project: Natural Resource Technician

Sponsored By: Western Center for Community College Development/Oregon State University/ NCSR

Date: December 4, 1997

Data Facilitators: Lester Reed
Oregon State University

Fred Wood
Walla Walla Comm. College

Panel Members:
Gary Galovich, Oregon Dept. Fish & Wildlife
Scott Hopkins, Bureau of Land Management
Rob Wessberg, Willamette Mission State Park
Tom Worcester, Fisheries Department,
Mt. Hood Community College
Hank Wujcik, Public Works Department,
City of Salem, OR

E. Community Relations	E1 Respond to public complaints	E2 Incorporate volunteer participation	E3 Make public presentations	E4 Construct informational materials and displays	E5 Respond to public inquiries	E6 Supervise youth projects	E7 Maintain partnerships
	E8 Provide technical assistance to landowners	E9 Prepare public documents	E10 Conduct and facilitate stake holders meetings				
F. Managing People's Impact on the Ecosystem	F1 Interact with resource users—one on one and in groups	F2 Conduct user surveys	F3 Review regulatory permits	F4 Manage resource access	F5 Develop informational materials	F6 Facilitate cooperative agreements with landowners	F7 Enforce regulations
	F8 Assist landowners with land management plans	F9 Map boundary/property lines					

MORE KNOWLEDGE AND SKILLS

Knowledge:
Read a map
Communications
- Write in standard English
- Oral competency in interpersonal and public speaking
- Listening skills

Computer Software
- Spreadsheets
- Word processing
- Databases
- GIS
- Graphics

Chemistry
Mathematics
- Statistics
- Applied geometry
- Intermediate algebra
- Angular trigonometry

Biology/Microbiology
Geology
Building/Equipment Maintenance
Mechanical
Swim
Operate 4-wheel drive off-road vehicles

Equipment and Tools:
Power tools
Map and compass
Boats
SCUBA equipment
Operate 4-wheel drive & off-road vehicles
Computers
- Database, word processing, spreadsheets
- Geographic Information Systems

Electroshocker
Binoculars
Hand tools
Firearms
Ground positioning satellite stations
Range finder
Traps and nets
Flow meter
Telemetry equipment
Video and audio equipment
Data loggers
Handheld radios
Cameras
Water quality sampling/testing gear
Forestry measurement tools

Work Behaviors:
Punctuality
Work independently
Reliable
Motivated
Team player
Know when to ask questions
Professional appearance
Willing to work in adverse conditions
Willing to work long/odd hours
Willing to volunteer
Good interpersonal skills
Lifelong learner
Willingness to travel
Flexible
Unbiased and accurate
Integrity

RESOURCE ECOLOGIST TECHNICIAN: A scientifically trained, multi-disciplined individual who applies a variety of skills which facilitate sound management practices in Agriculture, Natural Resources and Ornamental Horticulture.

DUTIES

TASKS

A. Demonstrate Communication Processes	A1 Apply inter-personal skills	A2 Be a creative problem solver	A3 Perform effective writing skills	A4 Be able to implement conflict resolution techniques	A5 Be able to teach or train coworkers
	A6 Be able to address a group confidently and persuasively	A7 Participate in political processes	A8 Be able to perform and model leadership skills	A9 Be able to perform public speaking skills	A10 Be able to educate/enlighten public
	A11 Cultivate partnerships; network	A12 Recognize steps/procedures to reach goals	A13 Be able to teach realistic, obtainable goals	A14 Be able to interpret	A15 Be able to demonstrate appropriate assertiveness
	A16 Be able to share successful or unsuccessful treatments or processes	A17 Be able to present information	A18 Be able to contact Resource agencies	A19 Be able to work with experts in special fields	A20 Be able to work with diverse populations
	A21 Demonstrate effective interview skills	A22 Be able to follow directions	A23 Be able to market product knowledge		
B. Demonstrate a Professional Demeanor	B1 Understand customs/practices of different cultures	B2 Be willing to work with diversity	B3 Be able to interpret rules/regulations pertaining to personnel	B4 Be able to keep up with technology	B5 Be able to interpret and follow Environmental Laws/Regulations
	B6 Be flexible	B7 Be able to market product knowledge	B8 Be able to develop a professional resume	B9 Be able to perform employee evaluations	B10 Be able to demonstrate effective interview skills
	B11 Do a self-evaluation	B12 Model leadership skills	B13 Be aware of career opportunities and limitations	B14 Be a self-starter; be productive	B15 Recognize your limitations

DACUM Project: Resource Ecologist Technician

Sponsored By: Shasta College/NCSR

Date: January 12, 1996

Data Facilitator: Ron Wheadon

Data Recorder: Francis Duchi

Panel Members:
Cathy Bartels, Farm Credit Services
Sandra Dupret, Trinity County Resource Conversation District
Bill Eiler, Eiler Ranches
Jeanean Falletti, Turtle Bay Park and Museum
Robert Frazier, USFS
Stan Gorden, Shasta College
Thomas Jordan, Shasta County Opportunity Ctr.
Cindi Juhasz, U.S. Bureau of Reclamation
Vanza Rising-Smith, California Dept. of Transportation
Shelly Stoltenberg, Fall River Feed Store
Roxanne Turkovich, Carter House Natural Science Museum
Linda Weaver, California Dept. of Fish and Game/Adopt-a-Watershed

B. (continued)	B16 Inspire others	B17 Follow through on commitments	B18 Follow directions	B19 Work unassisted	B20 Demonstrate a good work ethic	B21 Work with little or no supervision	B22 Recognize the ability of disabled populations
	B23 Read periodicals and professional journals	B24 Be involved in professional organizations and support groups	B25 Develop partnerships	B26 Perform effective writing skills	B27 Dress appropriately with safety and utility in mind	B28 Recognize the limitations of others	
C. Demonstrate Effective Business and Financial Processes	C1 Apply effective planning skills	C2 Demonstrate organizational skills	C3 Operate computers	C4 Operate office machines	C5 Evaluate competitors	C6 Identify prospective customers	C7 Determine if you are able to meet customer needs
	C8 Be able to qualify customers	C9 Demonstrate time management	C10 Develop and monitor budgets	C11 Be able to do forecasting	C12 Develop a business plan	C13 Read and interpret a financial plan	C14 Interpret tax laws
	C15 Initiate employee safety training	C16 Perform effective personnel management	C17 Be able to apply for a loan	C18 Collect data	C19 Interpret data	C20 Keep up with technology	C21 Market product knowledge
	C22 Apply basic math skills	C23 Utilize accounting and bookkeeping skills					
D. Evaluate, Monitor, Maintain and Improve the Ecosystem	D1 Calibrate; use, repair and maintain equipment	D2 Analyze weather patterns	D3 Analyze soil	D4 Analyze water cycles	D5 Analyze plant characteristics	D6 Recognize toxic situations	D7 Perform ecological assessments
	D8 Collect field specimens	D9 Prevent toxic buildup	D10 Utilize information from resource agencies	D11 Work with experts in special fields	D12 Collect data	D13 Be able to read and create maps	D14 Use GIS
	D15 Operate/understand GPS/GIS	D16 Apply basic surveying skills	D17 Analyze/balance life cycles and energy flows	D18 Analyze air quality	D19 Analyze the chemistry relationship in plants/soil/ environment	D20 Operate CAD	D21 Read Natural Resource Indicators
	D22 Analyze wildlife/livestock	D23 Know geological impacts	D24 Apply alternative methods of pest control	D25 Know ecosystems	D26 Utilize restoration techniques	D27 Recognize pests/diseases	D28 Prescribe treatments for pest/diseases

ntinued)	D29 Use Integrated Pest Management skills	D30 Utilize evapotranspiration data					
E. Perform Effective Research Processes	E1 Explain successful or unsuccessful treatments or processes	E2 Work within a timeline	E3 Survive in adverse outdoor environments	E4 Be able to do grant and technical report writing	E5 Be aware of resources	E6 Collect data	E7 Interpret data information
	E8 Use computers and software	E9 Be able to use a library	E10 Be able to prioritize	E11 Present information	E12 Contact resource agencies	E13 Delegate	E14 Know basic math, basic algebra, and statistics
	E15 Be able to plan	E16 Demonstrate organizational skills	E17 Operate office machines	E18 Calibrate, use, operate, and repair equipment	E19 Collect data	E20 Operate and understand GIS/GPS data	E21 Analyze and balance life cycles and energy flows
	E22 Analyze the chemistry relationship in plants/soil environment	E23 Know how to determine necessary equipment	E24 Know ecosystems	E25 Read and create maps	E26 Be connected to periodicals, organizations, and support groups		
F. Additional Equipment Exposure Beyond Existing Equipment	F1 NATURAL RESOURCES*	F2 AGRICULTURE*	F3 HORTICULTURE*				

APPENDIX

F1-Natural Resources:
Relaskop
Water quality equipment
Densiometer
Altimeter
Packing equipment
Erosion control equipment
Chainsaw

F2-Agriculture:
Soil moisture equipment
Chipper/shredder
No-till drill

F3-Horticulture:
Backhoe
Chipper/shredder
Erosion control equipment
Manual shift vehicle
Quad ATV
Multimeter
Soil testing equipment
Survey equipment

*** See Appendix**

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement (OERI)
Educational Resources Information Center (ERIC)

JC 990 223

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