

Forest Inventory and Analysis Program
LICHEN SPECIALIST
TRAINING AND QA PROCEDURES

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*Revised from documents co-authored by Bruce McCune, Peter Neitlich, and Susan Will-Wolf
June 2007*

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INTRODUCTION -- AND ACKNOWLEDGEMENTS

This document is revised annually or less frequently as needed, to update and clarify language. The lichen indicator field protocols have remained stable since 1994 (McCune and others 1997a, b). Recommended training time and the basic components of training have also remained stable since 1994; improvements, updates, and new approaches to training are tried each year. Successful modifications of training approach and details are incorporated into this document. QA blind checks were added to the program starting in the late 1990s. This document is substantially revised from Neitlich and Will-Wolf (1999). The contents of this document evolved from earlier documents authored by Bruce McCune, Peter Neitlich, and Susan Will-Wolf, and from critiques and contributions to training and QA by the many contractor lichen specialists and FHM and FIA field crews who have contributed evaluations and feedback.

McCune, B, J.P. Dey, J.E. Peck, D. Cassell, K. Heiman, S. Will-Wolf, and P. Neitlich. 1997a. Repeatability of community data: species richness versus gradient scores in large-scale lichen studies. *The Bryologist* 100:40-46.

McCune, B., J. Dey, J. Peck, K. Heiman, and S. Will-Wolf. 1997b. Regional gradients in lichen communities of the southeast United States. *The Bryologist* 100:145-158.

Neitlich, P. and S. Will-Wolf. 1999. Lichen Indicator Training Plan. Forest Health Monitoring Program: Lichen Communities Indicator. Internal FS document

PART 1: TRAINING

PARAMETERS FOR PLANNING AND SET UP

Advanced Planning

1. Determine the number of people to be trained, the training staff needed, develop a budget, and identify funding at least 2-3 months in advance of a training. Identify the lead trainer as soon as possible.
2. Determine space needs and other logistical needs based on the total number involved with the training.
3. The lead trainer and the lichen indicator advisor (IA) work with regional FIA field season managers to use a general FIA training site or identify and propose a separate training site.
4. The lichen IA provides master files for all needed crew training manual chapters to the regional coordinator at least 1 month before training.
5. The lichen IA provides the lead trainer with all general training materials and a list of needed trainer supplies that the lead trainer obtains.
6. The lichen IA and the lead trainer collaborate to prepare all supplementary, region-specific materials including species lists, simplified identification keys, reference samples, etc.

Training Site Requirements

Lichen Diversity: The two primary field requirements for a good lichen training site are high lichen diversity and access to diverse forested stands. In practice, this means holding the training in a relatively clean air area with good access to a variety of forest stands. The lichen IA should coordinate as needed with other IAs and regional FIA staff to assure that the prospective training site is appropriate.

Workspace: A large, unshared classroom or lab that will be available all day and evening for the entire length of the training (including setup and post-training) is needed. The room needs to have ample electrical outlets for microscope lamps, and water nearby for dealing with laboratory chemicals. Space must be able to accommodate:

approximately 4 linear feet of table space per trainee for interactive lichen teaching stations and other microscope work
seating for talks and slide presentations

enough extra room for display of a collection of local specimens

Equipment:

At least one dissecting microscope per lichen trainer is needed, and at most one dissecting microscope per trainee is desirable.

Several power strips and extension cords are needed.

Other Logistical Needs: Access to photocopier, computer with printer if possible.

Time Requirements

Length of the training should vary according to the skill level of the crews. Training time is counted in multiples of half-day blocks, and includes at least 1 block for certification testing. The duration of each teaching block should be at least 3 hours, but 4 hours is preferable. For beginning crew with no previous lichen experience, 2.5 days are needed. Most 1- year returning crew need 1.5 days of training, unless there is a demonstrated problem with lichen collection skills (previous season QA, for example), and for 2+ year returning veteran crews, 1 day is required. An alternative for a 2+ year veteran crew with a good QA record is for a Lichen Specialist to meet the crew on the first standard plot of the season for a 2 hour refresher and on-plot certification.

2+ year returning veteran crew who are candidates to perform QA blind checks (regularly score around 90%+ on certification and blind checks) should receive extra training in addition to standard 1-day veteran recertification. This can be accomplished via these crew serving as training assistants for ½ day, or via an extra review session with a trainer, or some other method arranged with the lead lichen trainer.

Number and sequence of time blocks and days for each component of training

In general, it is best to program taxonomic activities for the mornings, as this is the time of maximum concentration and good outdoor light. If the training is held concurrently with other indicators, all attempts should be made to give lichens the morning sessions, and certainly for the first two days of new crew training.

When lichen training is held concurrently with other indicators:

flexibility is possible for scheduling the first three half-day blocks, but there must be 4-8 working hours between the certification plot and recertification and/or field trip day (usually the fourth and fifth blocks for new crew), so trainers can identify and evaluate crew certification plot samples. There also needs to be at least 4-8 working hours after the certification plot for 1-year returnees or veterans (3rd block or 2nd block respectively) for ID. Recertification of 1-year returnees or veterans is not part of scheduled training time, so the regional crew training coordinator and the lichen lead trainer need to work something out if necessary. Scheduling training of returnees and veterans early in a training week facilitates emergency recertification during contracted trainer time. Otherwise, the region must pay the extra cost for additional training time. Region coordinators consult with lead trainers for trainings involving times other than those recommended. Longer trainings have never been done other than as stand-alone events and in special circumstances. Shorter training time could be negotiated if, for instance, new crew have some earlier lichen training experience before the FIA training.

Training Staff

1. In general, one trainer per 3-4 crew members is needed for a full new-crew training (see above for training requirements), and one trainer is needed per 5-6 veteran crew members.
2. One lead trainer is needed; (s)he must have more skills and may be paid at a higher rate than the assistant trainer. The lead trainer plans the training, scouts field sites and sets up the indoor workshop, and directs the training.
3. Assistant trainers as needed help with last-minute setup and help conduct training. A worthy, highly skilled veteran crew member (see instructor requirements below) is qualified to assist with training.

4. An identification specialist participates during the last two days of training specifically to help identify certification samples

Instructor Requirements

1. Hiring Guidelines

Lead Trainers: Lead trainers need to have specialist-level skills in lichen taxonomy, need to be good teachers, and need to be well-versed in FIA methods and typical crew questions and problems. Lead trainers should have been an assistant regional trainer or auditor, preferably for two or more years, and must have a demonstrated ability to identify most macrolichen species in the region. If possible, that individual should have been an assistant trainer *in that region*. This person would plan to attend a lichen pretraining if there is one, or would be instructed by the lichen IA, as a requirement to be a trainer. In the lichen indicator, specialists perform the identification of field samples, relying on established microscopic and chemical tests. They often have several peer-reviewed publications on lichens, and have worked with the FIA program or have used the method for related activities. It is the responsibility of the lichen IA to select and train lead trainers. They then are contracted directly by the lichen IA or by the region after the lichen IA has agreed to their role.

Assistant Trainers: Assistant trainers are a critical part of the training program, and tend to be as helpful as the lead trainer in teaching basic lichen discrimination to crews. They may be selected by the lichen IA or by the lead trainer as delegated. In addition to potential lead trainers, they may include people in the following categories:

- A good lichen ecologist or lichenologist without FIA-specific experience, but with demonstrated ability to identify the macrolichen species common in the region and with teaching experience.
- An experienced lichen crew veteran (2+ years) who has demonstrated ability to identify macrolichen species common in the region, and has either had teaching experience or has previously assisted with field training.

Assistant trainers need to attend a lichen pretraining, or would be instructed and certified by the lead regional trainer early in training, as a requirement to be a trainer.

Note: Formal lichen pretraining sessions should be held every third or 4th year. In other years, trainers will be trained and certified by the lead regional trainer just before crew training at that site.

Identification Specialists: An ID specialist may attend a portion of a smaller training to assist the Lead Trainer with identification of lichens from practice and certification plots as well as other activities. The ID specialist needs to be very skilled at identification of macrolichens in the region, but needs no teaching experience.

Veteran Crew Assistants: Worthy veteran crew members (2+ years) can at the discretion of the lead trainer assist with classroom and field teaching for the indicator. Those who regularly find 90% or more of the species a lichen specialist finds are candidates to conduct QA blind checks; assisting at training prepares them for this.

2. Work Expectations

Lichen training is very intense, both for lead and assistant trainers. Hours tend to be long and grueling. Trainers should be aware that their jobs involve 10 hour days during the setup phase, and 14-16 hour days during the training itself. Much of the additional time required comes in identifying trainee samples in the evenings.

Time Needed for Set-up

If trainers need to collect local materials for teaching stations and reference collections, then 3 days are recommended for set up. If materials are already available, or mostly so, and the training site is already familiar, up to 2 days is recommended. More time may be needed to choose plot and trip locations at new training sites. All trainers should be present for the final day of set-up. Activities include:

- Gathering lichens for teaching stations and reference collections (3-4 hours)
- Laying out teaching stations and answer keys (3 hours)
- Compiling reference herbarium, if needed (3 hours)

- Setting up the rooms (1-2 hours)
- Choosing field trip, practice plot and certification plot sites (1 day)
- Conducting, certification plot surveys (5 hours)

Certification and Practice Plot Requirements

The certification and practice plots should be chosen to represent as much of the potential forest lichen diversity in the region as is available at the training site. Plots should be located to reflect, *at a minimum*, the average species richness of the state or region, and should strive in all cases to reflect species richness much higher than this. Attention to this requirement will ensure that crews are exposed to the lichen diversity of their region, and have mastered this diversity by the end of training. Since this is a prime concern in the training, training location must be chosen with this requirement in mind.

Who May Attend Lichen Trainings

Lichen communities training can be a popular event, and there has been interest among FIA personnel and FHM and other agencies to send personnel other than field crew and QA crew members. This can present a difficult situation for lead trainers who are forced either to turn people away or to make accommodations which detract from crew training.

Presence of non-crew members presents several major problems for the lichen training:

- Lowers the teacher to crew ratio, and distracts the trainer from focusing on the crew training needs
- If non-crew members are superiors of crew members, the latter may defer to or be inhibited by their superiors and not ask questions or ask for attention crucial to crew acquiring the skills they need.
- Extra expense and/or effort is required to identify samples from the certification plots of non-crew members. In practice, this is typically \$75-100 per person per plot.

Because of this, we recommend the following strict guideline:

Training should be open only to FIA personnel doing lichen sampling that season or directly involved with managing this indicator. If a region strongly desires that extra personnel attend a crew training, they need to arrange this in advance with the lichen IA and lead trainer and fund extra trainers to accommodate the extra trainees.

While sometimes unpopular, this guideline will result in better training for crew members. FIA national pretraining might be a more appropriate place/time to offer lichen indicator training to non-field FIA personnel who wish it.

TRAINING PLAN

Lichen Indicator Training/Field Manual

The basic training module is designed to explain and elaborate on the several hundred page lichen training/field manual which contains the following sections:

The lichens methods chapter of the FIA P3 field manual

Basics (What is a lichen, lichen morphology, illustrated glossaries, where to collect lichens, etc.)

QA (The latest official version of our QA plan, including crew MQOs, certification requirements, and QA methods)

Mailings (Plot data cards and specialist mailing forms)

Rationale for the lichen communities indicator

Reprints 1: Lichens and Air Pollution

Reprints 2: Regional Species Lists and Publications

Lichen 911 and contact information

The following session plan is skeletal in order to avoid duplicating the training manual. Lead trainers are free to rearrange the schedule as needed, as long as all critical parts are covered

Outline of Training Plan

The lichen training consists of the following basic components:

Introduction to FIA lichen communities indicator--purpose, rationale, methods, examples, basic lichen ecology. This is normally a slide or powerpoint program. Lead trainers are furnished with an FIA image set, and are free to supplement or substitute. (20 min - 1 hour). Examples should be from the region as possible.

Lead trainer presents objectives of the training session, schedule and explanation of testing activities including practice, certification and scoring. (10-15 minutes)

Introduction to lichen identification--basic lichen morphology, structures and how to use them to discriminate among species (0.5 hours)

Learning lichen characters, species discrimination, and lichen genera in the classroom and field through any appropriate combination of the items below (4-8 hours):

tutorial workstations (2-4 hours)

examining demonstration material in conjunction with regional species lists (1-2 hours)

making and examining personal collections (2+ hours)

field work (2 hours)

genus workstations (1 hour)

informal evening activities (e.g., keying, study, etc)

any other activities

Lichen indicator methods and detailed explanation of field crew responsibilities (1 hour)

Field outings to practice field discrimination of species and lichen indicator methods (2 hours)

At least 1 practice plot for new crew (4 hours each)

Certification plot (4 hours)

Retesting if needed (4 hours)

Additional field outings to other regional sub-climates as appropriate (1 day; can be held concurrently with recertification)

Total Time: 20 hours (2.5 days) minimum daytime scheduling for new crew, less for returning crew (see p 2 under Time Requirements). Informal evening practice with trainers present is strongly encouraged, but it should never substitute for scheduled day time when crew must be alert and not fatigued. Additional time can be scheduled as arranged with region coordinator.

See sample training schedules in the appendices.

Training Objectives

By the end of the training, crew members should be able to:

Collect the majority of lichen species present on a plot and assign proper abundance scores

Describe the basic lichen structures and features of a lichen

Describe the 3 basic growth forms of lichens and how to discriminate among them

Apply basic principles of lichen morphology to discriminate among as many as possible of the epiphytic species in the region

Describe the concept of substrate specificity and give several examples using local species

Recognize many of the most common genera in the region - by name is desirable, not required.

Conduct FIA lichen plots according to standard field methods

Follow protocols on plot time and collection locations and substrates on the plot

Describe the range of microhabitats to examine

Recite the cardinal FIA lichen rule: "When in doubt, it's a lichen"

Collect appropriate sizes of specimens

Know how to deal with uncertainties relating to species identity and abundances

Describe the steps needed to complete the lichen specimen requirements after the plot

Drying and storing specimens

- Packet labeling requirements
- Plot data cards
- Mailing forms and mailing protocols
- Understand the basic goals and objectives of the lichen indicator and how individual lichen plots will be used in regional and national context, including:
 - The basic concept of lichen decline in areas of poor air quality and the indicator in general
 - The importance of lichens in the ecosystem
- Pass the certification
 - Achieve a species collection score of 65% or higher of the trainer's score
 - Conduct all FIA plot methods appropriately
- Understand the contents of the FIA Lichen Communities Manual
 - Read methods section
 - Read basics section
 - Knowledge of how to use forms in the mailings section
 - Knowledge of QA, Publications sections for reference

Certification Requirements

A crew member is certified if they have found at least 65% of the lichen species that a trainer has found on the certification plot. Failing crews may take the recertification test.

Preliminary Testing Exercise: The lichen indicator will informally score the results of the practice plots as if they were a certification plot, as time permits. This is generally accomplished by having crew spread out their practice plot samples for the training staff to examine. Each training staffer will have made an informal list of what they saw on the practice plot, for comparison with crew samples.

Field Test: Lichen certification (see above) is based completely on a field test which includes performing the lichen survey with higher than 65% species capture compared to the lead trainer, filling in proper abundance coding, and packaging and labeling plot samples for mailing to the specialist, in this case the lead trainer.

Retesting Materials: Another certification field test, as above.

List of Equipment for Training

Each item is followed by the responsible party who will coordinate the arrangements and financial outlays for these items.

- Microscopes - one per person, if possible, but no fewer than one per two people. At an absolute minimum, at least all trainers must have scopes. (Typically borrow from region--regional staff to coordinate)
- Teaching Stations printouts and corresponding lichens (Indicator Advisor and lead trainer collaborate)
- FIA Training Manuals (Indicator Advisor provides master files/copies and instructions, region coordinator reproduces and assembles for crew)
- FIA packets for certification samples. Number estimated by lead trainer. Can be on high quality scrap paper with one side used. (Indicator Advisor provides template, lead trainer decides on number and possibly provides for staff, region coordinator provides for trainees).
- High quality scrap paper for practice packets, or else new paper. Amount estimated by lead trainer (Region)
- Markers (Region)
- Soft Pencils (Region)
- Rubber bands - 1 box per crew member for field season (Region)
- Slide Projector and Slides/laptop and projector (Slide projector/laptop and projector from region. Slides/electronic presentation from Indicator Advisor and lead trainer)
- Overhead projector as requested by lead trainer (Region)
- Field Guides - 1 for each crew member and trainer. Examples: *Macrolichens of the Pacific Northwest* or, *Lichens of California* for PNW/CA training, *Bungartz Arizona Macrolichens* (for FIA) for southern IW (Indicator Advisor to coordinate/recommend purchases by region. Many trainers will have their own copies--check before ordering.)

Hand lenses (Region)
Knives (Region)
Pruners as decided (Region)
Watch (Crews)
Laminated Field Card (Region)

REPORTING REQUIREMENTS FOR TRAINERS

Off-frame Stand Data Sheet

This data sheet (sample below) should be filled out completely for each certification plot.

Lichen ID Data Sheet

A Lichen ID Data Sheet (sample below) appropriate to the region should be completed for trainers and all crew certified for each test plot and submitted to the lichen IA. The lichen IA will prepare electronic data files.

Data Quality Evaluation Form

Either this form (sample below) should be filled out and provided to the crew, or some other equivalent written notification of certification results should be provided to crew. Copies should be submitted to the region coordinator and to the lichen IA.

Voucher set

A complete voucher set for each training site should be prepared and sent to the lichen IA. If a trainer uses a site over multiple years, they may add any new species found at a training to the set. This set documents the training site and the training staff as a whole, not individual trainers or ID specialists. The lichen IA will maintain a voucher list for each site and update it after each training.

Report

A brief written report (1-2 pages) outlining the training schedule, certification scores, site notes, recommendations, etc. should be prepared and submitted to the lichen IA with the Lichen ID Data Sheets, vouchers, and Off-frame Stand Data Sheet within 2 weeks after the training. The summary report should be submitted electronically, All other written products may be submitted electronically, but hard copy is equally acceptable.

PART 2: QA Activities – Hot Audits and Blind Checks

PARAMETERS FOR PLANNING AND SET UP

Auditor Requirements

Only certified lead and assistant trainers may conduct hot audits, which include recertification of crew members. Blind checks may be conducted by certified lead and assistant trainers as well as by qualified crew who have been trained and certified to perform blind checks. These crew typically have collected for more than 2 years and have consistently performed around 90% of a trainer's score on plots. They are identified before a training and given extra instruction by the lead trainer.

Planning

The region communicates with the lichen IA and the auditors about the number and location of plots to sample for

audits and blind checks, and collaborates on organization of field visits performed by contract lichen specialists. The FIA region pays all costs for contract lichen specialists to perform field hot audits or blind checks, while typically the national lichen indicator budget pays costs for identification, data entry, and reporting of audit and blind check samples

AUDITS

Background

Audits serve two primary purposes: (1) check in with the field crew to see if they are having any difficulties with the method, and (2) documenting the data quality. The first objective is achieved by talking with the crew, observing the method in progress, and providing immediate feedback. The second objective is met by calculating numerical scores (comparing results to those of the lichen specialist) based on the field crew sampling a plot without interference from the auditor. One or more plots will be examined per audit. Note that the early steps provide immediate feedback to the crew, but the later steps quantify the data quality with increasing rigor.

Methods

1. The auditor asks the crew member if they have questions concerning the method before the sampling begins, then discusses those problems with the crew member. (If time allows the auditor to be present for two plots, the first plot should be done more interactively, with the specialist helping the crew).
2. The auditor then allows the crew member to sample on their own, but observing at a distance the manner in which the crew member covers the plot. At the completion of the plot, the lichen specialist quickly assesses the number and quality of specimens and provides immediate feedback on the specimens and other aspects of technique (for example, coverage of plot and substrate, assignment of abundance values, completion of paperwork). Normally it is fairly easy for a specialist to judge how well someone is doing, even before the final scores are in. The specialist then samples the plot independently.
3. The specialist identifies the lichens, then evaluates the number of species obtained by the crew member as a percentage of the specialist's. These field scores are reported by the specialist to the lichen IA and crew member as soon as possible: occasionally the same day, but usually within a week.
4. If the crew member appears to have passed the hot audit with >70%, the remaining steps are followed with no urgency. If the crew member failed the hot audit, the crew member is no longer certified to collect lichens. The region coordinator is notified as soon as possible. Corrective actions, as appropriate and feasible, are initiated via communications between field crew, regional coordinator, lichen specialist, and lichen IA. The original crew member may not collect lichens until retrained and recertified, which can be done on the next scheduled plot if feasible.
If the crew member's passing score is <70%, step 5 should be completed as soon as possible, while the crew member continues to collect lichens. If the crew member passed, the season proceeds as planned. If the crew member failed, corrective actions as outlined in step 4 need to be taken.
5. The specialist sends (with tracking) the specimens to the lichen identification specialist for the state for final identification, and lab scores are calculated.
6. After the data are delivered from the specialist to the lichen IA, the species scores for both the crews and the specialists are entered into data files.
7. Results of the audit are communicated to the region and QA specialist in a summary QA report prepared at the end of the field season, or earlier if requested by program managers.

BLIND CHECKS

Background

Blind checks document data quality, though they do not affect in-season crew performance. Crew re-measurement by crew or others who are not lichen specialists can document between-crew consistency of performance, but they do not document achievement of the field MQO for adequate species capture to place the plot on a regional gradient

within the desired range of measurement error. Only crew who have been specifically trained and certified may perform blind checks.

Documentation of achievement of the field MQO is met by calculating numerical scores comparing crew results to those of a lichen specialist (or someone with documented lichen specialist level of skill in field species capture) based on the lichen specialist sampling a field crew plot without the crew's knowledge.

Methods

1. The field crew samples a plot during their regular schedule.
2. The regional lichen ID specialist identifies the lichen species from this plot according to normal procedures.
3. A trainer/auditor specialist resamples the plot independently, in special circumstances this may occur in a year or two following the crew sampling.
4. That specialist submits the lichens from his/her plot to the regional lichen ID specialist.
5. After the data are delivered from the specialists to the lichen IA, the species scores for both the crews and the specialists are compared, and data are entered into data files. In the past we have found that if trainees obtain 65% or better of the number of species obtained by the specialist, that the plot index scores (below) will mostly fall within 10% of the specialist's.
6. Results of blind checks are communicated to the QA specialist in a summary QA report prepared at the end of the field season, or earlier if available. They are used to assess quality of data collection in a region, and do not affect in-season crew performance.

FIA Lichen Indicator - Off-frame Stand Data Sheet

Selection criteria: minimum stand area >1.5 acres, semi-natural or natural understory

Set up standard FHM/FIA Plot for Training

(area 40828 ft² = 0.937 acres = 3783m² = 0.378 ha)

can be 34.7 m = 114 ft radius circle for other off-frame uses

Observers _____

Date: _____ 20____
 Plot Number: _____

Contact Name: _____

1. Standard lichen community data plus plot data card (see lichen field methods manual).

2. Stand location

- a. State _____ b. County _____ c. elevation (units) _____
- d. latitude/longitude _____ N _____ W
- e. location in words (attach maps if applicable)

3. Stand tree basal area: Take five wedge-prism counts, 1 at plot center and the rest on N, S, E, W radii about 2/3 out from plot center.

_____ BA factor of prism	Tree counts conif. hardw. _____ 1 Center _____ 2 North _____ 3 East _____ 4 South _____ 5 West _____ averages Basal area (ft ² /acre or m ² /ha): _____ = average * BA factor Total basal area _____ (circle units)
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4. Proportion of BA in conifers _____ %

5. Topographic position

6. Slope _____ degrees or % 7. Aspect _____ degrees E of N

8. % gap _____ Recent? (<5 yr) Y N w/ Tall Shrubs? Y N

9. Dominant tree species (name, % cover)

10. Major shrub species (name, % cover)

Lichen Identification Data Sheet -- *SAMPLE*

Plot No. 02NVplotA

Field Collection Date July 29, 2002

Lichen specialist Neitlich

County, State Casino, NV

Collector W. Tidwell

ID Date 10/05/02

= Coll. No. **A** = Abundance on packet. **Abun** = Final Abundance (see rules). **Sp. Code** – See Epiphyte Master List

Species Name		FINAL DATA		DATA FROM PACKETS								Comments	
		Sp. Code	Abun.	#	A	#	A	#	A	#	A		
1	<i>Flavopunctelia soaredica</i>	2704	3	1	3	7	2	5	0				
2	<i>Melanohalea subolivacea</i>	4017	3	3	2	8	2	9	3				Not sectioned
3	<i>Physcia adscendens</i>	5701	1	6	1								
4	<i>Physcia biziana</i>	5705	3	2	1	5	2	11	2				
5	<i>Usnea hirta</i>	8041	2	10	2								
6	<i>Xanthomendoza fallax</i>	8203	2	4	1	12	1						
7	<i>Phaeophyscia hirsuta</i>	5605	0.01	11	0								
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													

3/2003

Abundance codes used by field crews: **1** = Rare (1-3 individuals seen), **2** = Occasional (4-10 individuals seen), **3** = Common (> 10 individuals seen), **4** = Abundant (more than half of the legal substrates have this species).

Species codes: Refer to Lichen Species Master List for lichen species code numbers.

Data Quality Evaluation -- Lichen Communities

Used for Certification and Audits

Name _____

Region/study _____

Date _____

Plot _____

Trainer/auditor _____

Trainer # spp _____ Crew # spp _____

Percent of species
detected _____

Evaluation:

Comments:

< 65% = Practice!! You didn't pass.
65% - 75% = Congratulations!! You passed!

75% - 85% = Good Eye!
> 85% = You could be a trainer!

Sample Training Schedules

Schedules from three trainings – a 2.5-day new crew in conjunction with a 1.5-day experienced crew training, a 1-day experienced crew training, and an extended 4-day new crew training – are included.

This schedule was used for the 2.5-day 2006 new crew training in IW/MT. It was held as a stand-alone event in Condon, MT in conjunction with the veterans' crew lichen training below.

NEW Crew Training

Wed. June 7th – Morning, 8-9am

(for all 10 folks)

- Introductions
- Review lichen references & equipment
- State training goals, review training schedule.

Wed. June 7th – Morning, 9-noon

- Power Point Presentations on FIA Lichen Program, Plot, & Lichen Morphology
- Hands-on introduction to lichen morphology

Wed. June 7th – Afternoon

- Lichen Walk – finding and observing lichens and seeing differences
- Look at specimens under dissecting microscope

Thurs. June 8th – Morning

- Plot set-up
- Practice Plot with trainer/crew discussion
- Review what everyone found, estimated scores

Thurs. June 8th – Afternoon

- Short review / question period
- Certification Plot

Fri. June 9th – Morning

- Certification Plot results
- Wrap-up
- Teacher evaluation

June 9th – Late Morning

- Re-test, if needed.

This schedule was used for the 1.5-day 2006 returning crew training in IW/MT. It was held as a stand-alone event in Condon, MT in conjunction with the new crew lichen training above.

1-YEAR RETURNING (and >1 yr with poor QA record) Crew Training

Wed. June 7th – Morning, 8-9am

(for all 10 folks)

- Introductions
- Review lichen references & equipment
- State training goals
- Review training schedule then separate into groups.

Wed. June 7th – Morning, 9-noon

- Lichen morphology review indoors and outdoors

Wed. June 7th – Afternoon

- Lichen FIA Plot set-up
- Lichen Plot & Collection discussions
- Practice Plot

Thurs. June 8th – Morning

- Review & Question period
- Certification Plot
- Teacher evaluation

Fri. June 9th – Morning

- Re-test, if necessary.

An update on FIA lichen data results should be offered as a short evening program or included as no more than 15-20 minutes of the first morning block.

This is an example of a 1 day returning crew training.

2+ YEAR (with good QA record) VETERAN Crew Training

DAY 1 – MORNING , 8-9am

- Introductions
- Review lichen references & equipment
- State training goals, review training schedule

DAY 1 – MORNING, 9-noon

- Lichen morphology review indoors and outdoors
- Review and update FIA lichen field and mailing protocols

DAY 1 – AFTERNOON, 1-5 pm

- Review & Question period
- Certification Plot
- Trainer evaluation

DAY 2 or later

- Re-test, if necessary.

An update on FIA lichen data results should be offered as a short evening program or included as no more than 15-20 minutes of the first morning block.

4-day(extended) new crew training: This schedule was used for the 4-day 1998 training in PNW/CA. It was held as a stand-alone event in Corvallis, OR. This was, from the indicator's perspective, an ideal training event. Crews had 100% certification rate the first time, and scores were generally very high. Trainers had high confidence in the ability of these crews, and crews had high confidence in their own ability. A more expensive training like this would be a useful investment for new crew especially in regions/subregions with known high lichen diversity.

DAY 1

8:00-9:00 - FHM introductory paperwork for field crew members (1 hour)

9:00-9:10 - Introductions (10 min)

9:10-9:40 - Slide presentation: Lichen morphology, ecology and FHM slide presentation (30 minutes)

9:40-12:00 - Lichen workstations (2.5 hours)

12:00-1:00 - Lunch

1:00-3:00 - Practice plot/training walk in hardwoods outside Suislaw SO to look for genera, look-alike species, and lichen morphological characters (2 hours)

3:00-5:00 - Genus workstations, review lichens using regional epiphyte species lists, examination of look-alikes. Priority genera: *Parmelia*, *Hypogymnia*, *Bryoria*, *Usnea*, *Physcia*, *Physconia*, *Esslingeriana*, *Platismatia*, *Xanthoria*, *Candelaria*, *Leptogium*, *Pseudocyphellaria*, *Sticta*. (2 hours)

5:00 - Lay our weary thalli to rest.

DAY 2

8:00-9:00 - FHM Methods (1 hour)

Overview of Lichen Community Indicator and how data is used
Conducting the plot
What and how much to collect
Scoring abundance
Other data needed
Post plot follow-up (paperwork, drying specimens, mailings)
Lichen 911

9:00-12:30 - Practice Plot at Mary's Peak : work in groups of 3-4 with at least one experienced crew member in each group. (2.5 hours)

12:30-1:30 - Lunch

1:30-2:00 - Debriefing of practice plot (30 min)

2:00-5:00 - Practice Plot. Work independently. *Practice hard! Everyone must pass tomorrow!* (3 hours)

DAY 3

8:00-11:00 - Continue genus stations, look-alike species. Begin keying using McCune's westside field keys and PNW macrolichen flora. (3 hours)

11:00-12:00 - Collection and data problems in past years (1 hour)

12:00-1:00 - Lunch

1:00 - 5:00 - Certification plots. Location TBA. (4 hours)

DAY 4

7:30 am - 8:00pm Trip to Sisters (East-Side Ponderosa Pine-Juniper Forest)

Morning: Training walk on E-side species

Afternoon: Off-frame plot. Those who didn't certify will have a second chance on this plot. Leave for Corvallis by 4:00 pm.

Lichen Indicator Slide Show Contents

A standard library of images is available to lead trainers from the lichen IA for use and modification at their discretion.

The introductory slide show for new crew generally touches on the following topics:

- The importance of lichen epiphytes in forested ecosystems
- The rationale for the lichen communities indicator
- The FIA lichen communities process, from data gathering to analysis
- Basic macrolichen forms and structures

Talks will need to vary by region, according both to the ecological roles of lichens in the region, the state of the lichen indicator in the region, and the pollution issues of a region.

Outline of Lichen Methods Talk

PROCEDURES

During this talk, refer to the methods "cheat cards" distributed to each crew member.

Sampling area. The area to be sampled is a circular plot with 120' radius minus sub-plots (=114 ft radius)

Sampling time. Sampling continues for a maximum of two hours or until 10 minutes elapse with no additional species recorded and all sectors of the plot have been covered. At least 45 minutes must be spent searching the plot OR/WA, even if very few lichens are present. At least 30 min must be spent in CA.

A **reconnaissance walk** through the entire lichen plot should be taken to locate lichen epiphytes on woody plants, collect voucher samples and assign abundances.

Lichens to collect. Collect epiphytic fruticose and foliose lichens.

Substrates to collect from. Woody plants (must be >0.5 m tall west of the Cascade crest to avoid ground lichens creeping up over moss on bases of trees and shrubs) within the lichen plot will be inspected for lichen species. Fallen and reachable branches will also be inspected. Rotten logs, stumps, and branches overgrown with ground mosses on the forest floor should not be sampled.

Where to look. Care should be taken to inspect the full range of substrates and microhabitats available: shaded and exposed, conifers and hardwoods, fallen upper branches and lower branches, large shrubs and trees in particular topographic positions (e.g. checking in draws or ravines of an otherwise uniform slope).

Abundance ratings. Relative abundance within the lichen plot will be recorded on each packet. Estimate as follows:

Code	Abundance
1	Rare (1-3 individuals on the plot)
2	Uncommon (4-10 individuals on the plot)
3	Common (>10 individuals observed but covering less than half the available substrate)
4	Abundant (covers more than half the available substrate)

Collect sample of each putative species, place in bag, record abundance. Revise abundance as needed throughout plot.

Bagging and Labeling. Each specimen will be placed in a separate bag (or folded and labeled paper packet.) Often there will be more than one species on a bark sample. If there is any chance of ambiguity about which species in the packet corresponds with which abundance rating, a clarifying phrase, such as “the white one” or the “sorediate one” should be written on the packet

Specimen size. Optimally, a palm-size sample of fruticose and foliose growth forms is collected. Even minute fruticose and lobate forms should be included. *Cladonia* sp. squamules lacking upright stalks should not be included. Collecting large samples improves the likelihood of picking up inconspicuous species that may not have been noticed in the field. These additional species can be recorded in the office.

PUT PLENTY OF MATERIAL IN LICHEN SURVEY PACKETS!!!

How to handle uncertainties. Field observers will frequently have uncertainties about the classification of an organism. The following rules are designed to put the onus of the responsibility for classification on the specialist, not the field crew:

When in doubt, assume it is a lichen.

When the growth form is in doubt, assume it is a macrolichen

When the species distinction is in doubt, assume two different forms are two different species.

Wrap Up - Complete plot packing slip. Time ended, comments on plot, lichens, veg, weather, mood. Important to know about extenuating circumstances (good or bad).

WRITE NEATLY!!!!

POST PLOT

Packaging samples, preservation and storage. Packets should be stored in a dry place until delivery to the program coordinator. Specimens should be thoroughly air-dried to avoid decay. Place bags from single plot in larger bag with plot packing slip. Never put lichens in plastic bags.

Send 1st 2 plots ASAP; then every week or every other week.

Quality control. Only those who have successfully completed lichen training should collect the lichen community data. Only those who successfully pass audit certification should continue to collect the lichen community data.

Mailing packets. Send packets to the designated person - the regional lichen specialist or the program coordinator with an accompanying mailing form listing plot #s.

Legal Substrate for Lichen Collections

From **Interior West Survey P3 Field Procedures, Version 3.01**

March, 2007, http://www.fs.fed.us/rm/ogden/data-collection/pdf/p3_manual_07.pdf

Page 6:

Collect a specimen of each macrolichen species on the plot for identification by a specialist. The population being sampled consists of all macrolichens occurring on live or standing dead woody plants, excluding the 19.7 inch (0.5 m) basal portions of trees, snags, saplings, and shrubs. Include in your sampling recently fallen branches on which the canopy lichens still look healthy (usually down for no more than a few months). Branches and logs left from recent harvests are legal substrate. Older down woody debris and any sawed or human-treated wood surfaces are not legal substrates.

Pages 9-10:

Lichen species with the following growth forms will be collected:

fruticose and foliose (i.e., macrolichens).

- Inspect woody plants (trees, saplings, and shrubs > 19.7 inches tall (0.5 m tall)) within the lichen plot for lichen species. This includes dead trees.
- Be careful to inspect the full range of substrates and microhabitats available:
- shaded and exposed
- both live and standing dead trees,
- conifers and hardwoods
- branches and twigs on trees
- recently fallen (judged to be from above 19.6 inches (0.5 m) healthy lichens plus branches and twigs on which the canopy lichens still look healthy (usually down for no more than a few months). Branches and logs left from recent harvests are legal substrates.
- shrubs
- trees in particular topographic positions (for example, check in a draw or ravine on an otherwise uniform slope, so long as it occurs within the lichen plot).
- Older down woody debris, decayed stumps, and any sawed or human-treated wood surfaces are not legal substrates.

From **Interior West Forest Inventory and Analysis Field Procedures, Version 3.01**

March, 2007, http://www.fs.fed.us/rm/ogden/data-collection/pdf/field_procedures_2007.pdf

Pages 143-144:

5.7.2 STANDING DEAD

Record the code that describes whether the tree qualifies as standing dead or not. To qualify as a standing dead tally tree, dead trees must be at least 5.0 inches in diameter, have a bole which has an unbroken ACTUAL LENGTH of at least 4.5 feet, and lean less than 45 degrees from vertical as measured from the base of the tree to 4.5 feet. See Figures 18-20 for examples.

“Unbroken” is defined as at least 50 percent attached to the original source of growth. The degree of lean on dead trees with partially separated (i.e., 1 to 50 percent) boles is measured from the base of the tree to the top of ACTUAL LENGTH.

Portions of boles on dead trees that are separated greater than 50 percent (either above or below 4.5 feet), are considered severed and are included in Down Woody Material (DWM) if they otherwise meet DWM tally criteria. For western woodland species (Appendix 3) with multiple stems, a tree is considered down if more than 2/3 of the volume is no longer attached or upright; do not consider cut and removed volume. For western woodland species with single stems to qualify as a standing dead tally tree, dead trees must be at least 5.0 inches in diameter, be at least 1.0 foot in unbroken ACTUAL LENGTH, and lean less than 45 degrees from vertical.

Live and dead standing tally trees, and partially separated boles of dead tally trees, do not have to be self-supported. They may be supported by other trees, branches, or their crown.

Note for lichens: It is not necessary for a dead (or live) standing tree to be >5 in in diameter to be legal substrate.

Page 145:

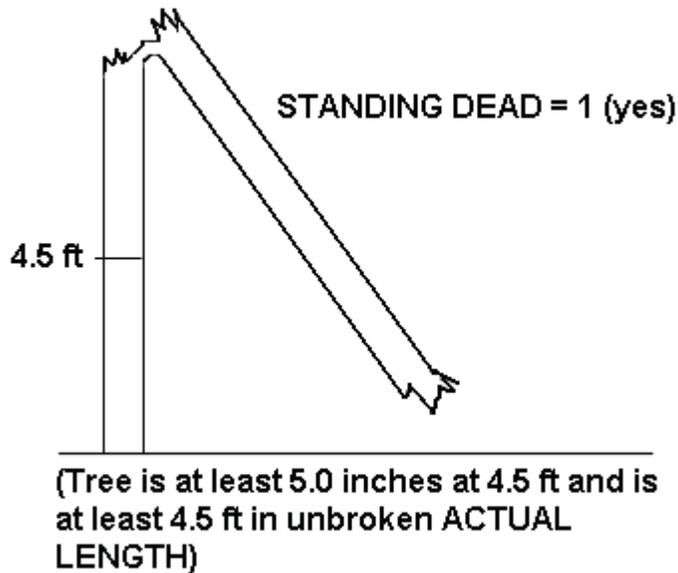


Figure 18. Example of an unbroken bole to 4.5 feet.

Note for lichens: Lichens may be collected on any part of the standing dead tree above 0.5m.

Page 146:

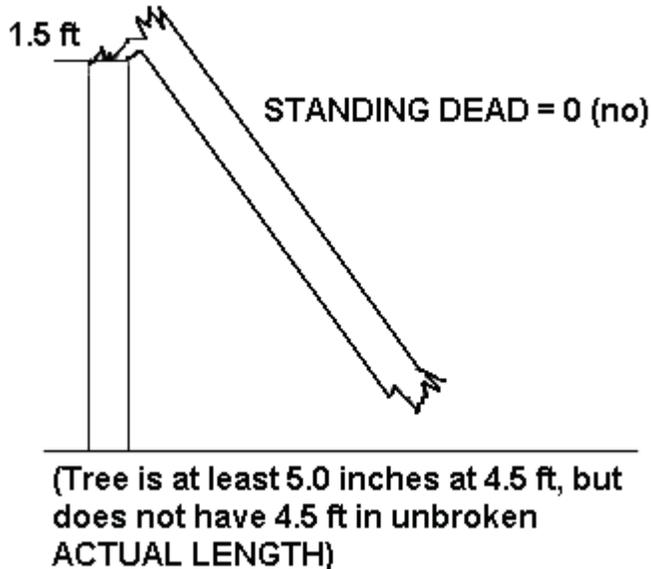


Figure 19. Example of an unbroken length of < 1.5 feet.

Note for lichens: Lichens should only be collected on what was above 0.5m IF the tree recently fell and the lichens appear healthy.

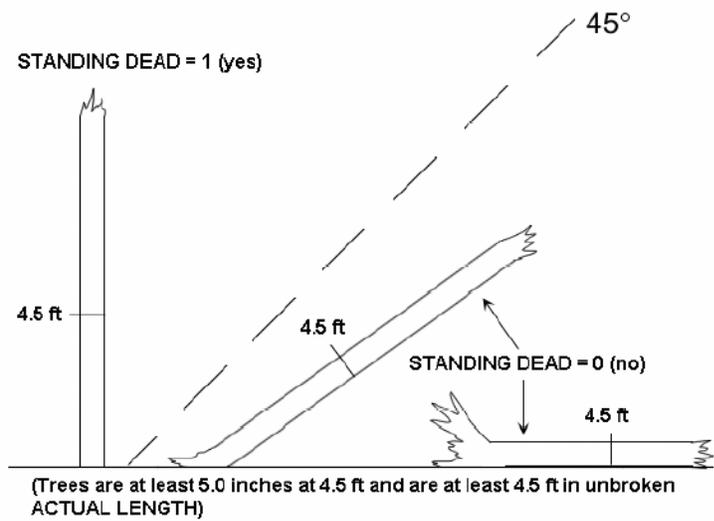


Figure 20. Other examples of dead trees.