

INFORMATION AND POLICIES FOR STUDENTS AND VISITING SCIENTISTS

FLATHEAD LAKE BIOLOGICAL STATION DIVISION OF BIOLOGICAL SCIENCES THE UNIVERSITY OF MONTANA

Graduate student training is a fundamental role of the Flathead Lake Biological Station (FLBS) and an essential aspect of our research program. We also host a variety of visiting scientists and postdocs (hereafter also referred to as visiting scientists). Concepts and philosophies in this policy statement are intended to provide guidance for students and scientists mentored or hosted by FLBS faculty. Feedback is encouraged, but we expect students and visiting scientists will support and adhere to these general policies and guidelines at all times on and off the Station grounds.

This document was partially excerpted from the graduate policies of the stream ecology laboratory of Professor Stuart Fisher, Arizona State University, Tempe. We thank Dr. Fisher and his colleagues and students for their willingness to share their ideas.

A. THE STATION

The Flathead Lake Biological Station was established in 1899 and has provided field-based mentoring of graduate students from UM and elsewhere. An important milestone in the development of FLBS as a research and graduate education facility occurred in 1980 with the appointment of Dr. Jack Stanford as Director, residing full time at the Station as well as functioning as a member of the UM graduate faculty. Large grants for construction of the Freshwater Research Laboratory and basic research on the structure and function of the Flathead River-Lake Ecosystem were awarded at this time as well, which initiated a full-time administrative and research staff. The growing research program substantially augmented the long history of field-based college coursework during the annual summer academic program. Today the Station is recognized by The UM system as a Center of Excellence and has a full compliment of facilities and equipment to mediate state-of-the-art research in ecology. Limnology is emphasized.

B. RESEARCH AND GRADUATE EDUCATION AT FLBS

The purpose of FLBS research is to enhance collective understanding of the aquatic and terrestrial environments, particularly the Flathead River-Lake Ecosystem, through free inquiry and scientific discovery. Our research is ecosystem based, requiring a multidisciplinary approach. Therefore, while graduate student or visiting scientist research may focus on specific topics, the training program is broad, including a robust understanding of organismic biology and ecology as well as the conceptual, empirical and computational complexities of the biophysical interactions of ecosystems.

The faculty at FLBS embrace education as a major goal of the research enterprise. Therefore, we involve and mentor undergraduate as well as graduate research. However,

our focus is on consistently recruiting and producing graduate students that rank among the best in the Country. We define success of the graduate program in terms of novel scientific papers produced, papers presented at national meetings, grants, other awards and job placement after graduation. High quality, productive and hardworking graduate students are an essential part of our successful research program.

C. FLBS ADMINISTRATION

Graduate students and visiting scientists report to their faculty advisor/host within the administrative hierarchy of FLBS. Each FLBS faculty member is responsible to the FLBS Director, who in turn is administratively supervised by the Vice President of Research at UM. Final decisions regarding academic operations (i.e., research, teaching, service) of FLBS are made by the Director in consultation with the faculty. In the academic arena all faculty, including the Director, are members of the Division of Biological Sciences (DBS) and the Organismal Biology and Ecology (OBE) graduate program. We are, therefore, also responsible to DBS/OBE faculty and our fellow faculty annually reviews our performance. You may view annual review documents in the "Resources/Files" folder on the FLBS server.

FLBS has an Assistant Director of Operations (ADO, Sue Gillespie) and an Assistant Director of Facilities and Properties (ADF, Mark Potter). The ADO supervises administrative functions including accounting, budgeting, scheduling, housing, commissary and human resource services functions in consultation with the Director. The ADO has the responsibility to solve administrative problems without involving the Director whenever possible. Therefore, the ADO is the person students should seek first regarding questions about Station administration and management. The ADF oversees maintenance of buildings, water and sewer, vehicles, boats and the grounds in consultation with the Director. The ADF and his assistant, the Resident Caretaker (Eric Anderson), are responsible for Station security and safety. Students are required to contact the ADF, ADO or Director any time real or potential security issues (e.g., fire, trespass, dangerous wildlife, storms, treefall) arise and the ADO, ADF or Resident Caretaker have supervisory authority over all activities pertaining to safety and security. For example, the ADF determines boat use on Flathead and other lakes and administers communications between students and the Station when on the lake. The ADF has written an insightful perspective of his role in graduate mentorship and in assisting visiting investigators (see Appendix A).

Keep in mind that overall function of the ADO and ADF and their staff is to facilitate the research and teaching mission of FLBS. Their jobs are essential to the smooth operation of the Station and they require your full cooperation at all times. Their job is to help you do yours, but that requires routine two-way communication. The ADO and ADF will meet with each new graduate student to go over basic, daily operations of the Station.

The Director and Resident Caretaker reside on the Station grounds and all students must know how to contact them in case of emergencies. The ADO, ADF or faculty members will respond if no one else is available on site.

University policies are Station policies. The University policy manual may be viewed at <http://www.umt.edu/hrs/PersonnelPolicies.htm>. However, we have some important operational rules specific to the Station. These include such things as limits on where alcohol may be consumed on the grounds, what to do in case of emergencies, where swimming and boating are allowed and so on. These rules are provided in Appendix B. Read them and adhere to them at all times. We expect our graduate students to be role models for undergraduates and visitors and to always be professional and above-board representatives of FLBS. Failure in this regard will result in dismissal from the program.

D. ACADEMICS AND RESEARCH

1. PRINCIPAL INVESTIGATOR/PROJECT DIRECTORS (PI/PD)

Faculty are the Principal Investigators/Project Directors (PI/PD) of nearly all research projects at FLBS, except in some cases where visiting investigators bring their own funding with them. The PI/PD is responsible to FLBS, the University and to funding agencies for managing and executing the research projects entrusted to them as PI/PD. The PI/PD is responsible for management of their specific research, which includes the process of putting together people, ideas, facilities and opportunities, and providing the intellectual leadership required to fulfill the goals and objectives of specific grants and contracts. Management of research grants and contracts must also include planning for continuation of PI/PD-initiated research programs, as well as proactive participation in cooperative research. Sustained grant funding depends upon goals being met, equipment being acquired and maintained, high quality results being produced and published, new ideas being generated and grant proposals being written and funded.

Each PI/PD must maintain contact with day-to-day research activities of their students, staff and faculty colleagues at the Station. This includes design of experiments, collection and analysis of samples, interpretation of data and presentation of results. This is generally done through interaction among faculty, graduate students and/or other research scientists working cooperatively on a research project.

2. GRADUATE STUDENTS

It is difficult to generalize about graduate students because of their individual strengths and weaknesses and because their role changes during progression of their graduate career. A key point is that the FLBS faculty is interdisciplinary in approach and practice. Thus, we accept graduate students across a diversity of interests and try to point them in the most exciting and promising avenues of research, usually a research element featured in a funded project. FLBS graduate students almost always receive the full financial support allowed by the University, mainly from funded projects in the form of a Research Assistantship. In return, we expect students to execute their research at the highest level of quality, to explore new research leads, and generate new ideas. We expect students who accept this investment of ideas, time and money from us to complete, to the best of their abilities, the project described in their Program of Study. This includes submission of their research results in the form of peer-reviewed journal papers. We view this requirement to

publish the results of your work as a moral obligation to society, because our research is publicly funded. It is also your moral responsibility to FLBS, to your advisor and to other faculty at FLBS who have invested intellectual capital, time and financial resources in your education and research.

You are not being paid to do a job, but you receive a stipend to participate in full-time, cooperative research. Therefore, you work on the FLBS schedule and not the semester schedule of the main campus. You may be asked to assist in acquiring data or performing a task in the lab that is not part of your specific research topic, but contributes to the overall advancement of FLBS. We cannot over emphasize the importance to our students of grasping the concept of cooperation. A lack of cooperation in spirit, as well as in deed, leads to isolation and is destructive to both group dynamics and personal relationships. You will find the faculty and scientific staff at FLBS very generous with their time and ideas. We expect the same in return.

Graduate students are being trained to be independent researchers. While we try to involve graduate students in important, existing research areas, we do not “give” them projects, rather we provide starting points for the research. Often, experiments or sampling regimes associated with core research, as outlined in a grant proposal, are carried out by graduate students who are focusing on that topic. This contribution is expected of students, but their own projects should go beyond this point and generate new questions, new hypotheses and new concepts.

Graduate students engaged in research are expected to interact, to share ideas, to cooperate and to collaborate. Throughout the tenure of the student’s research activity, the major professor should have a prominent role in these interactions. As the student’s research project begins to gel, the student’s prerogative should increase. But at all stages, the student is expected to be open with data and ideas, and above all, to keep their advisor informed about research progress. This is essential, since as their mentor and as the PI/PD on the grant that is supporting them, the PI/PDs are the one with ultimate responsibility for the expenditure of funds and the accomplishment of research goals and objectives.

There is a delicate balance between cooperative, collaborative research and individual, independent achievement. This is especially true as it applies to graduate students who, on the one hand, are expected to function successfully in a cooperative research endeavor, and on the other hand, must demonstrate independent creativity to satisfy degree requirements and to establish their own professional reputation. Some students will be required to work together very closely because of specific overlapping research sites. Other students may operate more individually, again depending on the specific project. Regardless of the level of field cooperation, all students are expected to actively interact, share ideas and contribute to meeting the objectives of the research project(s). There is no single way to meet this challenge. However, each FLBS faculty member as a PI/PD and also as a major professor attempts to be sensitive to these issues. Again, effective communication between students and the major professor will facilitate development of an optimal balance in each individual case.

We only accept and keep students who share our goal of excellence and who set the highest standards of intellectual inquiry and production. We accept only the most qualified students and their success in achieving their graduate degree is expected, encouraged and supported. All FLBS graduate students are members of the graduate program of our campus academic home, the Division of Biological Sciences (DBS), Organismic Biology and Ecology Program. Therefore, DBS/OBE policies and guidelines also apply and should be thoroughly understood. These may be viewed at <http://biology.dbs.umt.edu/dbs/obegradregs.htm>.

3. STAFF SCIENTISTS AND RESEARCH TECHNICIANS

FLBS employs several full-time research scientists and technicians. These people are not independent researchers, but are supervised by and responsible to the FLBS faculty. We have very competent scientists and technicians, some of who have worked at FLBS for many years and have developed special skills and can be of great help to graduate students. Although technical help is available to student researchers at all levels, graduate students must not negotiate directly for significant allocations of time from the staff scientists, but must obtain approval of the supervisor for anything other than routine assistance. The same applies to staff in approaching graduate students for assistance. In general we want a working environment where everyone feels free to help out others, as long as that activity does not interfere with timely completion of assigned duties. In some cases a graduate student may be supervised on daily tasks by a staff scientist; but, that is usually short term and specified in the student's approved research plan.

4. VISITING SCIENTISTS

Faculty of FLBS may host visiting scientists to work with them on projects. In all cases this is a cooperative arrangement that must be approved in writing by the Director. All of the policies and considerations in this document apply to visiting scientists.

E. OUTREACH TO OTHER INDIVIDUALS, LABS OR AGENCIES

It is very important to exchange ideas, discuss problems and form more permanent collaborations both within and among students under a specific faculty mentorship, with students mentored at FLBS, and with other students and faculty from the UM campus and/or scientists at other universities or state or federal agencies. We encourage our students to attend scientific meetings, to correspond with scientists elsewhere and to generously offer expertise and ideas to others.

However, we ask that you discuss potential contacts and collaborations with your supervisor or advisor first. The reasons for this are many. For example, you may wish to make a brief contact seeking research advice. However, your FLBS supervisor or advisor, or another member of the FLBS or OBE faculty, may be able to suggest a better source of help. Or, we may not wish to have contact with the person you have chosen for a variety of reasons, or we may prefer to try to solve a problem internally. This is not meant to

restrict contact, but rather recognizes the reality of relationships and interactions. This is usually considered a matter of courtesy.

Any outreach or potential collaboration that commits resources of the Station or a grant must be approved in advance by the Director and/or the PI/PD or both, for obvious reasons. Remember “resource” refers to money, equipment, supplies and your time. Again, we are delighted to have graduate students and staff form alliances with others at FLBS and with people in labs on the UM campus or elsewhere. Such interactions enrich a education, experience and understanding. However, do this through your supervisor or advisor. It may save you the embarrassment of having to go back to someone to explain you simply do not have the time to allocate to a project because of prior commitments elsewhere.

F. FREEDOM, INDEPENDENCE, OWNERSHIP AND ARCHIVING OF DATA

It is essential that scientists have freedom of inquiry and the right to investigate promising leads independently. On the other hand, individuals have responsibilities that may be dictated by a grant, a dissertation proposal, a degree requirement or an employer. Each of these limits one’s freedoms. These opposing forces may be especially strong in cooperative research or when long-term goals of a larger project shape research directions.

All data generated by research conducted at FLBS, whether for a dissertation project, an independent project or research by visiting scientists, technically are property of FLBS and The University. Of course, in practice, ownership of data is more complex than this.

Databases are among the most important resources at FLBS, and are managed by the FLBS Data Manger, Don Schenck. Indeed, one of the outstanding limnological databases in the world has been developed at FLBS and is maintained for internal FLBS use. FLBS open file reports and published papers can be made available to those who ask, but must be dispensed through the ADO so that records of requests and responses can be maintained and costs associated with transmission recovered. **No FLBS data, whether gathered by staff, students or faculty, will be provided to non-FLBS persons by anyone other than the Director. Violation of this policy may result in immediate dismissal.**

This edict is not to engender control for the sake of it. Rather, it is our responsibility to society, and the greater good of the ecosystems we work on, to manage all data for posterity. Conflicts arise when a researcher leaves a laboratory and takes data with him or her, thereby denying the lab (and often the public) access to these data. This is unethical and is tantamount to theft, just as if he or she spirited away a computer or a spectrophotometer purchased on grant funds. But, it is also unethical for a PI/PD to deny a graduate student the right to convert the data set collected under the auspices of a student’s dissertation into a creative work. Therefore, we require students to prepare their thesis or dissertation in publication format. In most cases, we require papers be submitted to a journal as a condition of approval for graduation.

Data generated by faculty, scientific staff, students or visiting investigators are proprietary for 24 months after completion of the project. That is, the student or other researcher has first right to work up these data for their dissertation and/or to produce professional publications from these data for up to 24 months after the completion of the project. Having done so, or after 24 months of failing to publish, the data will be available for use within the research group at FLBS as appropriate. Remember that all data generated and/or archived at FLBS are for use only by FLBS people. However, we want FLBS students, staff, faculty and authorized visitors to use our data. Clear communication about ownership of data, always involving the Data Manager, is usually all that is required. Conflicts will be resolved by the PI/PD, failing that, by the Director.

Data must be preserved in sufficient detail so inferences from those data can be fully re-evaluated. This means the “paper trail” from raw data to published manuscript should be complete. There are no data collected by any researcher that are immune from this principle, i.e., no “private” or “personal” data; no data too poor to include; no “tangential data, not related to main project” and no “premature” data.

It is the responsibility of PIs to manage data collected with public funds and to insure their security and availability. It is also the responsibility of the PI to supply all digital data to the data manager in a form the data manager deems retrievable over the long-term. These data files must be well documented – a file with strings of data and no column headings or no units for the variables, no dates, sites or methods is not of much use to anyone. Individual researchers are responsible for updating all data sets under their control and to do so in a timely manner.

- Field data notebooks may be stored in a safe place in personal FLBS offices, but must be available for perusal at any time. The same applies to all electronic data files. Notebooks and data files that are kept current and known to the data manager will make it possible for research to proceed based on preliminary results when publication of a data set is excessively delayed by a slow, disgruntled, departed or dead researcher. Field notebooks must be updated regularly into an electronic format and stored in the folder that has been provided by the data manager.
- A detailed database will allow PIs to assess the state of progress of different research elements and provide progress reports (e.g., to funding agencies, departments or visiting scientists) for evaluation of individuals or the entire project. The database will allow PIs to prepare timely grant proposals based upon current status of the research.
- Graduate student-maintained databases on thesis/dissertation research will help the student develop sound data management skills and will facilitate the mentor-student interaction.

A specific protocol for collecting and archiving data must always be developed in consultation with the data manager and appropriate faculty. Researchers may have as many data files as required to adequately organize their data. All data collected in the field and

recorded into hand-written field notebooks must be transcribed into an electronic format following the project-specific protocols.

In general, we expect all project archives to contain the following:

1. All raw data and metadata (methods, when, where, etc.) in spreadsheet format, usually per FLATDAT (subject to new name), which is the primary archival system developed by Don Schenck.
2. Files with data summaries – Any preliminary or final versions of tables, graphs or whatever.
3. Files of statistics used to reduce the data. These should be clear enough so that anyone could repeat what you did.
4. Text of any written material associated with the data, including all tables and figures and correspondence associated with publication. This requires careful tracking of manuscripts as they move through the review and revision process.

Not all materials exist in an electronic form. Thus, upon completion of your thesis/dissertation, all hard copy materials including field notebooks, maps, permission letters, correspondence, copies of methods papers (if not otherwise available in the lab), etc. should go in a hard file that is archived in the FLBS library supervised by the ADO. Nothing is to be removed from field data notebooks once entered. New or updated versions of data in progress should be added to old versions, but old versions should be retained. This is critical because FLBS records have been subject to discovery in legal proceedings where FLBS research was relevant.

Access to individual electronic and hard notebooks is by permission of PIs or individual researchers only. Certain data sets will be classified as OPEN after publication or with permission of the PIs and individual investigators.

These requirements of data maintenance during the project and archival after the project apply to all researchers working at FLBS: PIs, visiting scientists, postdocs, techs, graduate students and undergraduates doing research projects of any kind at FLBS as part of the research group.

Graduate students and other researchers should periodically review their electronic files and notebooks for completeness.

Anyone who cannot or will not adhere to these data management policies will be dismissed from the FLBS.

G. OWNERSHIP OF IDEAS

The origin of ideas is not only difficult to trace, but is one rife with potential for extreme conflict. This is especially true in labs, groups or disciplines where there is open discourse and free exchange of thought. Still, some scientists believe they generate ideas

de novo or publish concepts in a distinctive way independently of the influences of those around them. In fact, raw ideas are cheap, and while we should try to develop a knack for generating and sorting amongst them, the important thing is to develop ideas, whatever their source. Not only is this critical to the advancement of our science, but by doing this, we will invariably generate new ideas in the process. We should always go to great lengths to credit all contributors, however distant, to an idea or theoretical construct we address, even if we think it was born in our own brains. Remembering that we see what we do because we stand on the shoulders of giants past should keep us within some modicum of humility and out of trouble.

H. AUTHORSHIP OF PAPERS

There are several precepts that govern publication. In the majority of labs, policies are generally not well spelled out in advance, leaving the student tentative or confused about what is expected or even ethical. Self-interest is a strong motivator; yet, unchecked can be destructive to group dynamics, personal interactions, and ultimately one's career. There is a spectrum of opinion in science as to what constitutes a "right to authorship." Independent investigators, which each of our students are being trained to be, must decide this for themselves, but a consistent view is required when research is done collaboratively. Cooperative research is particularly common in ecosystem ecology; thus, it is worthwhile for graduate students in ecology to learn these issues. Below are some of the primary constructs we use that have developed through many years of experience. Not all faculty at UM or even at FLBS necessarily agree on each and every point; however, each of us have seen colleague's and student's credibility damaged and relationships brought asunder over this issue. At a latter date when you are an independent researcher, you may do some of these things differently. While you are with us at FLBS; however, we insist on doing it as follows unless you provide a compelling argument for change.

All students and visiting investigators are expected to publish their research and in each paper to credit FLBS as a sponsoring institution for the work. Authorship of products from a research project will be determined through discussion between sponsoring faculty and the graduate student or visiting scientist. **The general rule is if a student or visiting scientist receives a research assistantship or other form of financial support from a faculty member, manuscripts resulting from the work will be co-authored by the faculty PI of the project that provided the funding.**

It is the responsibility of the graduate student or visiting scientist to keep their FLBS advisor or sponsor well informed of research progress and engage them in research planning, execution and interpretation. This level of involvement will generally be sufficiently substantial to warrant co-authorship. If your advisor feels that his/her co-authorship is not warranted, then he/she will not accept it. In any case, discussion of authorship should be initiated as early as possible in the process. Talk to your mentoring faculty before you negotiate authorship with anyone, including other students or faculty. This will avoid hurt feelings that may ensue if your advisor's view does not match yours. The role of technicians, undergraduates, graduate students, visiting scientists and research assistants in research and creative activity is too complex an issue for any graduate student

or non-PI to handle independently. This is particularly true for the young researcher that is enthusiastic about their research and possible collaborations in a multitude of directions, all simultaneously.

Whether your faculty advisor is an author or not, the FLBS faculty insist on an opportunity for input to abstracts or manuscripts, preferably at an early-draft stage, but certainly before the final draft is submitted. This is to ensure FLBS/DBS/UM “boiler plate” is accurate and consistent, financial support is acknowledged appropriately, the research is rigorously supported and fairly stated, and the general quality of the manuscript is as high as we can make it before it leaves the lab. Under no circumstances are you to look to the “peer-review process” to accomplish editing of your work. This is an abuse of reviewers’ valuable time and will inevitably reflect poorly on you and FLBS.

You must not seek staff help on manuscript or dissertation preparation other than routine library operations. Staff help will likely occur at some point, particularly on the final draft of a manuscript to assure adherence to specific journal editorial requirements. However, staff help will be determined by the faculty in consultation with the ADO.

You may be involved in the collection of field data and/or the discussion of data and their interpretation in various forums at FLBS. This does not automatically warrant your inclusion as an author on a manuscript your advisor or any other faculty may prepare. In many cases, such a paper may be the culmination of several years of thoughtful preparation. Nonetheless, we are very open about what papers we are working on. If you have not been included as an author and feel you should have been, we will not take offense to your bringing this to our attention. The final disposition of the authorship will be a matter of those discussions in an open and constructive atmosphere.

I. SEXUAL BEHAVIOR

All members of FLBS, including technicians, graduate students, undergraduate students, postdocs, faculty and visitors have a right to work in a supportive, friendly, yet non-sexual environment. In many cases we are in close working conditions and sometimes in remote field sites that require camping in tight quarters where personal space may be limited. Students need to learn to interact and collaborate with others as professionals. This is difficult to learn when sex colors interactions. In a collaborative, interactive research group, as we have at FLBS, the faculty expect students and visiting investigators to understand and take responsibility for the effects of their actions on other individuals and on FLBS group dynamics. Be sensitive to this issue and always remain professional in your interactions.

Sexual harassment is a difficult and sensitive issue. Repeated and unwelcome sexual overtures constitute a serious form of sexual harassment. Coarse jokes or sexual innuendo can easily be offensive and when it is, constitutes sexual harassment. Contributing to a sexualized workplace also constitutes sexual harassment. These are all well spelled out in the University policies. No one need tolerate inappropriate behavior and incidents should be reported immediately.

J. GRADUATE RESEARCH PROJECTS

Ph.D. and M.S. students are required by the OBE graduate program to prepare a well-thought-through research proposal. This proposal must be submitted and approved by their Graduate Advisory Committee prior to their research getting underway. Students are advised to carefully read the OBE graduate program guidelines to remain in compliance with OBE/DBS requirements (see <http://biology.dbs.umt.edu/dbs/obegradregs.htm>). The following is meant to provide continuity among FLBS graduate students and expectations by the faculty.

All M.S. and Ph.D. research proposals are to follow the format of a NSF-style proposal. With advice from the major professor, and other members of the graduate committee, the M.S. or Ph.D. student will prepare and submit a research proposal to their committee and then present that proposal to all faculty and graduate students at FLBS. This does not substitute for a presentation in the OBE seminar series as may be required by DBS. In the end, the proposal may or may not be submitted to NSF or a funding agency. The faculty advisor will make that determination.

K. M.S. THESES

The main purpose of M.S. thesis research is to provide experience in all aspects of a research project, from conception to formal presentation. A successful M.S. program generates a well-rounded student versed in all aspects of the topic of their study and in the execution of an independent research project. Success is measured both by oral and written presentations in terms of how far the student has progressed and in the scientific significance of the products. Although not a University requirement, submission of a paper(s) from the thesis work to a professional journal is required for completion of the M.S. degree from FLBS. The typical M.S. program of study should be completed within two years.

Criteria for M.S. Projects

1. Likely to make a contribution to the science.
2. Central to the conceptual questions of the project.
3. Will contribute useful answers.
4. Broadly applicable to ecology.
5. Pilot studies or preliminary data are already available.
6. Matches specifically with student's professional goals and perceived training needs.
7. Addresses research questions, the answers to which are not known in advance.
8. Intellectually challenging, but within student's capabilities.
9. Methods are generally already well established, thus reducing risk of delay or, in worse case, failure.
10. Reasonable frequency of sampling and number of samples, not dependent on rare events or specific conditions, which may not occur every year.

11. Amenable to descriptive and/or manipulative field experiments (should have an experimental design).
12. Reasonable work load; need for technical assistance minimal.
13. Research should be in area of major professor's expertise so any required help is readily available.
14. Data collection feasible in one field season (e.g., Oct – Oct; May – Oct).
15. Research must be completed in a time frame allowing a full semester to complete analysis and write the thesis and journal paper (e.g., complete data collection fall semester, analyze data and write thesis and paper by end of spring semester).
16. High probability of success measured by oral presentation at a national meeting and publication in a scientific journal.
17. Financial cost reasonable (travel, equipment, supplies, software, etc.).
18. Exciting to both student and major professor.
19. Will contribute to better understanding of ecosystem and fits within the “mission” of FLBS.

L. Ph.D. DISSERTATIONS

The Ph.D. dissertation is expected to generate significant, complete and comprehensive results suitable for publication in the best journals of the field. A paper(s) from the dissertation must be submitted to a professional journal prior to completion of the Ph.D. degree. The Ph.D. research project plays a much greater, defining role for the student in terms of his or her standards of quality, breadth of interest and technical capabilities than for the M.S. student. The Ph.D. research project will determine successful attainment of jobs or postdoc opportunities and will greatly shape reputation of the student in the eyes of other professionals for several years after graduation. The Ph.D. can normally be completed within 3-5 years post baccalaureate. Successful completion of the Ph.D. degree is ultimately the responsibility of the student. Integral to Ph.D. research is embarking into the unknown. It is not uncommon for a student to have to redo work in order to attain sufficient data from an experiment or from a field season in order to adequately address one or more questions fundamental to the research as outlined in the formal research proposal. In other words, good intentions cannot salvage poor or lacking data. The Ph.D. is attained on merit, not good intentions or even brilliant ideas. Although not a University requirement, submission of a paper(s) from the dissertation work to a professional journal is required for completion of the Ph.D. degree from FLBS.

Criteria for Ph.D. Dissertation Projects

1. Will assuredly make a contribution to the science that is novel.
2. Conceptual questions relate to fundamental principles of the science.
3. Addresses research questions, the answers to which are not known in advance.
4. Will contribute useful answers.
5. Broadly applicable to ecology.
6. Pilot studies may or may not be already available.
7. Matches student's long-term professional goals and training needs.
8. Multiple outcomes possible; e.g., alternative hypotheses identifiable.

9. Intellectually challenging and will take student into personally “uncharted waters.”
10. Methods may be well established, but development of new or modified methods may be necessary in answering questions.
11. Rare or unusual events may be incorporated in the research design, given the enhanced probability that such events will occur during the longer tenure of Ph.D. students.
12. Must include manipulative field and/or laboratory experiments within a well-thought-through *a priori* experimental design.
13. A Ph.D. project normally encompasses 2 or 3 years of fieldwork and experimentation.
14. Availability of technical help can be negotiated to accomplish project.
15. Ph.D. projects have a substantial open-ended component requiring examination of multiple possible outcomes.
16. Pre-existence of pilot data is less important. Pilot studies may be done before or as part of the Ph.D. project.
17. Specialized training may be necessary to execute parts of the project (e.g., GIS, stable isotopes, multivariate statistics).
18. Exciting to both student and major professor.
19. Will contribute to better understanding of the ecosystem and fits within the “mission” of FLBS.
20. Contributes to FLBS in tangible ways enhancing the professional reputation of the institution.
21. Contributes new skills or techniques (e.g., statistical methods, field method, innovative experimental design) that help grow the BioStation.

M. ROLE OF THE GRADUATE ADVISORY COMMITTEE

In the USA generally, and at UM specifically, the role of the advisory committee is to advise the student on research and programmatic matters as the student progresses. Use your committee well and often, especially in reviewing manuscripts that you plan to submit for publication before the thesis or dissertation is completed. Even with this committee input, papers submitted or published prior to defense must still “pass muster” as contributions to, or chapters within, the thesis/dissertation. The committee is responsible to FLBS/DBS/UM for thesis or dissertation approval. Thus, your work must still be appropriately defended to the committee no matter how good the journal is that has accepted individual papers.

N. STRUCTURE OF THESES AND DISSERTATIONS

1. Theses/dissertations should include all work the student did as a part of their proposal. That is, it would be inappropriate to exclude work the student did, but on which he or she was not a first author. Likewise, it would be inappropriate for the student to cull work from the thesis/dissertation because it was difficult to defend, because their percent of involvement on a publication was very small. A student must learn to defend all aspects of any paper their name appears on. However, the

student should not include work done on a project that was not outlined in their thesis or dissertation proposal (i.e., work performed on a project as part of one's monetary support or as part of general project data collecting responsibilities in being a member in good standing with the supporting project).

2. A student's thesis/dissertation should be prepared as if for publication in a major scientific journal (usually we prefer the format of the ESA journal, Ecology) and organized as chapters.
3. At the beginning of each chapter (paper), authors should be listed as they will appear in the published version.
4. Only first-named or sole-authored chapters should be included in the thesis/dissertation proper, with rare exceptions approved by committee. Other manuscripts in which the student is a co-author should be included as appendices.
5. When a manuscript in the appendix would normally fit between chapters of the thesis main body, insert a short chapter summarizing the manuscript (an abstract) and refer the reader to the Appendix.
6. Long data sets, analytical methods, techniques, diagrams, photographs, computer programs, etc., should also be included in the Appendix.
7. Do not include any text that purports to describe your individual involvement in the conception, design, execution, interpretation or writing of any part of the thesis/dissertation. There are two reasons for this.
 - a) In any successful collaboration, these components should not be assignable.
 - b) As mentioned above, your being a co-author makes you responsible for defending every aspect of every paper appearing with your name on it.
8. All that you do must be consistent with the UM Graduate School thesis/dissertation format requirements.
9. The thesis/dissertation must be organized as a single document, which flows well and develops points sequentially. This continuity should be achieved by the first chapter, which may not be published in a journal, but is comprehensive in its treatment of the literature and the overarching research questions. In some cases, this first chapter to the thesis/dissertation may require detailed explanation and organization to tie disparate ideas appearing in separate following chapters that have been submitted as papers to different journals. A final chapter, also not necessarily for publication may be required, to present conclusions from the research as a whole. In any case, it certainly will not be enough to simply bind together a set of manuscripts or reprints. The whole will be judged separately as a reflection of your ability to organize and synthesize your research and present the research in a professional manner. In this respect you are indeed the sole author.

Meeting requirements of proper thesis/dissertation will be a full-time job and then some. Be sure to consult closely with your faculty advisor early and often during this process.

O. OVERARCHING PHILOSOPHY

Training graduate students and mentoring visiting scientists is an integral part of the research enterprise of a modern research university. Our job is to produce outstanding ecological scientists and academicians and to produce pace-setting papers in ecology. We recognize each graduate student or visiting scientist is an individual with a unique set of strengths and weaknesses. We will work together to tailor the level of advice and mentoring to your individual needs. Our intention is that each graduate student completing their training at FLBS will leave with a robust understanding of ecology and ecosystem science and be ready and able to use that science to advance human well being. Hopefully our philosophy will empower visiting scientists in the same manner.

Below are several important tenets we recommend considering as you begin your tenure at FLBS. These will arise often in your professional interactions with FLBS faculty as you develop your degree program or research project and turn your research interests into a project and finally into a dissertation and professional publications.

- The goal is to enhance understanding, not to just collect data.
- Sound research is built upon sound data.
- Ecosystem research requires multidisciplinary and cooperative approaches and mutual understanding.
- Modern ecological research is expensive; thus, research questions should be as significant as possible.
- The question or hypothesis should motivate the research.
- A weak test of a strong hypothesis is superior to a strong test of a weak hypothesis.
- Never let the availability of tests limit the questions you ask.
- Planned, properly replicated and controlled experiments conducted in the framework of a hypothesis-driven experimental design provide the strongest, most efficient means of gaining new information.
- Always generate multiple hypotheses and multiple predictions.
- Always look for alternative explanations for results obtained.
- Build on existing data and existing concepts.
- Always seek to be insightful, drawing from the full range of your experiences and understanding; this will allow you to take full advantage of a lucky break.
- The application of results to real world problems may be their most important use.

P. A FINAL NOTE

We want you to be successful. It is important to us that you achieve your full potential as a professional in the field of ecology. Your success is our success, but it requires hard work and long hours to be at the top of this field.

We want you to feel welcome and fully involved in the FLBS program. Talk freely with faculty, staff and students. Encourage one another. Ask questions if you are unsure about either the policies contained herein or “how things work” around the Station or the University. Ask again if you do not get what you feel is a mutually understood answer. Don’t let your concerns fester. Faculty members are very busy and may seem distracted or even uninterested at the moment, but please be assured we have your best interests at heart.

We foster a professional, high-energy atmosphere at FLBS and we expect excellence from all that work with us. We will push you hard. Yet, we view FLBS staff, students and visiting scientists as our “family.” We seek mutual respect and enduring friendship.

This document was prepared by J. Stanford through consultation with the FLBS faculty and staff.

Appendix A

FLATHEAD LAKE BIOLOGICAL STATION FACILITY AND PROPERTY USE ORIENTATION GUIDE FOR VISITING RESEARCHERS AND GRADUATE STUDENTS By Mark N. Potter

As the Assistant Director of Facilities and Properties (ADF), I would like to welcome you to the Flathead Lake Biological Station (FLBS). The commitment you have made to the Director on your course of study or research project brings a commitment of service to you by the Facilities Support Staff. We are a small staff with a broad range of responsibilities. It is important we work together efficiently. The Custodian, the Resident Caretaker and I expect you will need assistance with equipment, transportation and other logistical support. In addition, your safety while conducting research at this facility and in the field is an important concern and you will be expected to adhere to safety rules and guidelines. The following paragraphs refer to specific guidelines and policies that most directly pertain to the operation of the Facilities Support Staff. We hope the time you spend at FLBS is productive and enjoyable.

A. UNIVERSITY / STATION POLICIES

Become informed about University and Station policies governing the operations of FLBS. Your cooperation is appreciated and necessary for us all to work effectively toward the common mission of Flathead Lake Biological Station. Research equipment, tools, boats and vehicles are provided to enable faculty, researchers and students to accomplish their goals in accordance with the defined mission of research and education at Flathead Lake Biological Station (FLBS). **It is important to remember University policy does not allow for its properties to be used for personal use.**

B. BUILDING SECURITY

Everyone must be aware of the need to keep buildings locked and secured during times outside regular work hours. **Buildings must remain locked after 5:00 PM, until the next regularly scheduled workday begins.** If you are the last to leave a building after 5:00 PM, turn off the lights and be sure all doors are locked. Do not leave the Freshwater Research Laboratory, Elrod Building or the Maintenance Shop unsecured and unattended during off-hours. These buildings house expensive equipment that is critical to everyday operation. You are entrusted with keyed access to laboratories and buildings critical to your research needs. You become responsible for the security of that building when making a keyed entry. You are responsible for the security of your assigned office space during all hours. If security becomes a problem in shared office space, please consult with the Assistant Director of Operations (ADO) or the Assistant Director of Facilities and Properties (ADF). You may not feel the need to keep your personal computer or office space secure at all times, however, the person you are sharing space with might. Respect their needs and do your best to accommodate them.

C. DESIGN AND FABRICATION NEEDS

Research equipment and tools are available for you to use for your research and educational projects. Use the equipment and tools properly and return them in the condition they were issued. Notify the Facilities staff about problems with equipment so repairs can be made before the item is needed again. Stow equipment properly and do not clutter workspace. Keep your work area organized and free of tripping hazards. Put tools away at the end of every work session. If special design or fabrication requirements are needed for your research, consult with the ADF or the Caretaker. We have a well-equipped maintenance shop. Many of the tools can be dangerous to an inexperienced operator. In order for you to participate in construction or fabrication of equipment you must be thoroughly checked out on the safe operation of power tools, hand tools and other shop equipment needed for the project. Shop use will be closely supervised. You must see the ADF or the Caretaker to borrow tools/equipment for your project and items must be logged on checkout sheet. **Remember these tools must be returned to the shop after each use unless other arrangements have been made.** The tools you borrow may be needed by other researchers or for

maintenance needs. Your opportunity to use the shop is contingent on your ability to use equipment safely and responsibly, and your willingness to maintain a tidy work area. You must wear eye protection while in the shop. Hearing protection is advised when working in noisy conditions. If your project is incomplete at the end of the day, move your project aside, put away the tools you used and clean up your mess!

D. VEHICLE / BOATS / TRAILERS - SCHEDULING

The Biological Station has an assortment of vehicles available which you may be authorized to use after reviewing vehicle use policies and signing a vehicle use form. Travel Authorization forms are available outside the ADO's office and must be completed for each trip. A "VEHICLE USE" schedule board is also located outside the ADO's office. The information on this board helps eliminate conflicts with vehicle scheduling, service and repairs. Use of boats, rafts and utility trailers must also be noted on the schedule board. Remember to plan ahead and use the schedule board or there may not be a vehicle available when you need it! Vehicle keys are kept in the garage next to the Maintenance Shop. Make prior arrangements with the ADF or the Caretaker to obtain keys if the vehicle will be needed before 8:00 AM. Remember to record pertinent information in the vehicle log book for each trip.

E. VEHICLE USE

The maintenance staff will provide you with a clean, properly functioning and safe vehicle. Be responsible in the care and use of Station vehicles. If you are going into rough, brushy areas, please use the older vehicles. Clean up any spills (soft drinks or food) or mud tracked into the vehicles. Don't leave trash, gear or personal items in vehicles. **Dogs, pets and alcohol are not allowed in University-owned vehicles. Family or friends not employed by The University of Montana or officially registered as students at UM are not allowed to ride in a Station Vehicle unless they have signed a volunteer form to assist in the field and they are needed for the conduct of State business.**

The motor pool vehicles are parked in the area of the Maintenance Shop. The following protocol should be followed.

A vehicle that has been refueled, serviced and ready to use is backed into its parking space pointing forward, ready to leave. This parking position indicates availability per "Vehicle Use" board. Vehicles parked in the "forward-in" position have not been attended to since their last use. Please use this system when returning vehicles to the motor pool parking area. Pull *forward* into any available space and return the keys to the "key deposit" slot on the right side of the garage door. Please inform the ADF or the Caretaker of any mechanical problems you may have experienced with the vehicle so the problem can be remedied before the next use.

F. BOATS, BOATING SAFETY

Boating safety and responsible boat operation are very important. Beware of dangers such as strong currents, overhead and underwater hazards, cold water temperatures, high winds, rough seas and lightning. The sheer vastness of the surface waters of Flathead Lake may be disorienting in poor visibility and darkness. Be aware of current weather conditions and forecasts. Also watch for changing weather conditions, such as fast moving storm cells. Don't be caught in the middle of Flathead Lake or on open water during thunderstorms. Size up the surface conditions of the lake. Be sure you have enough fuel to complete your day afield. Make sure the boat has ropes, anchor, fire extinguisher, horn or whistle, lights, communication equipment (radio or cell phone) and life jackets. Be sure to take along proper clothing. Because of cold water temperatures, air temperatures over the lake can be very chilling, especially if you are wet. Postpone your fieldwork if conditions are marginal. Check the weather report. Consult with the Director, your faculty advisor or the ADF if you are unsure if conditions are safe enough to complete your day afield. Your decision to sample on any chosen day may be overridden if safety afield is in question. You are allowed to use non-motorized boats and canoes in Yellow Bay at your convenience, as long as conditions are safe and life jackets are available for each person. You must have Director's authorization to use FLBS canoes, rafts, and boats away from Yellow Bay.

G. FIELD TRIP PLANNING

Trip planning and communication while in the field are essential. Make sure you have travel authorization approved before departure. Short wave radios and cell phones are available for you to use on your projects. If a two-way radio is your communication link, be sure it works before departure. There must be someone monitoring the same frequency on a second two-way radio for this type of communication. Be sure to coordinate radio use with other personnel. If you rely on a cell phone, be sure to have phone numbers needed for communication with other personnel. Likewise, other personnel at the Station must have your cell phone number. Remember to leave your communication link **turned on** at all times! We must be able to contact you for our assurance of your safety or communication of important information.

H. 24-HOUR ASSISTANCE, EMERGENCY RESPONSE

Campus safety, security and emergency responses are concerns that must be addressed at all hours of the day and night. The Director and Caretaker live in residences on the campus of FLBS. In their absence, another resident or employee may be appointed to stand "on-call." The ADF lives close by and is also reachable at all hours. Do not hesitate contacting any of the above personnel with concerns relating to the safety and security of this facility or to report an emergency situation.

I. CAMPUS RESIDENCY

Please keep your FLBS residence clean and safe, inside and out. Store bicycles, canoes and other equipment neatly in the area provided with your residence. Do not clutter the apartment entrance or lawn with your trappings. Do not park your vehicle on lawns or leave your vehicle in undesignated parking areas. A student or researcher residing in an apartment or a cottage can have overnight short-term guests within their quarters without guest registration. Guests cannot stay in the dormitory, in a cabin or in an unoccupied apartment without registering with the ADO. All guests must be registered in advance.

J. SUCCESS IN YOUR RESEARCH

You are encouraged to become a responsible and valued member of the FLBS family. The duration of your research project or education here at FLBS will pass quickly. You will become part of the history of this Biological Station and memories of your stay here will endure. The guidelines above will help ensure the safe, efficient operation of this facility and successful achievement of your research and educational goals.

Appendix B

FLATHEAD LAKE BIOLOGICAL STATION *The University of Montana*

RULES AND REGULATIONS

1. No fires, cooking or camping on BioStation grounds.
2. Report accidents and fires immediately to the Director or maintenance staff.
3. No pets are permitted.
4. Alcoholic beverages allowed when preapproved and only inside dorm rooms, apartments and cabins. Use or possession of alcohol/intoxicating substances in any vehicle owned by The University of Montana is strictly forbidden.
5. No admittance to any buildings or rooms except those being used specifically by your class or group.
6. Rowboats and canoes may be used during daylight hours, but must remain in Yellow Bay; all boaters must have **life jackets on**. Please pick up and return equipment to the west end of storage building and help keep the area neat. Users are financially responsible for lost or damaged canoes, paddles, oars and life jackets.
7. **Park vehicles in designated areas only. Please do not park in housing area or staff parking lot.** No vehicles allowed beyond dormitory building. Observe 15 mph speed limit on station grounds.
8. No smoking is allowed in research or academic buildings, dormitory/apartment/commissary complex, cabins or meeting rooms (if you must smoke, do it outside in a safe manner). Please deposit all litter and cigarette butts in appropriate containers.
9. Please use sidewalks and pathways to avoid wear on lawns and native vegetation.
10. Laundry and shower facilities are only for people in residence at the Biological Station.
11. When planning to hike in the backcountry, please sign out at the Commissary. Give sufficient information so that if you do not return in a timely manner we will know where to look for you.

The Biological Station is an educational and research facility. We encourage everyone to have fun, but not at the expense of those who are working. Help us keep the grounds and laboratories neat and clean.

QUIET HOURS: 10:00 PM - 7:00 AM

Checkout time: 11:00 AM