III.   Programs

Programs at FSMLs encompass research, educational and outreach activities, and the technical requirements to support these activities. Ideally, planning processes dictate which programs will be pursued at a FSML, but in practice the process for adding programs is often quite *ad hoc*. An overall plan that allocates percentages of administrative effort, financial obligation, facility allocation or person-use days to each of these program types can be very helpful in determining whether a new program opportunity should be pursued.

Some FSMLs convene an advisory committee that helps determine content, policies and procedures for FSML programs. These committees are sometimes called "Scientific Advisory Committees" or "Academic Advisory Committees". In the narrowest application they may address only one type of program, such as a "Research Committee" or a "Curriculum Committee". However, FSMLs that have set up a broader advisory committee highly recommend the greater issue coverage because single program are not considered in isolation, but rather are examined holistically in the context of overall FSML activities.

These committees meet once every year or two, are composed of professionals from beyond the confines of the FSML, and when most effective are asked to consider planning issues proactively rather than in reaction to a specific event. For example, as part of a long-term planning effort a Scientific Advisory Committee might be convened for a two-day meeting to address whether a FSML should offer formal undergraduate research training programs. Committee members would consider the financial, social and academic advantages and disadvantages of starting and maintaining such a program, and would give the FSML Director the benefit of their collective experience and judgment.

A. Technical Support

   1. Libraries

      a. Issues

         The library needs of FSMLs vary from those facilities with only a few feet of library shelf space to full-fledged libraries with full-time staff.   A wide range of materials is appropriate, from a few field guides to:

              Maps
              Books, monographs and journals
              Photos, slides and aerial photos
              Access to digital versions of photo archives, journals, books, monographs, maps
                   and all other library materials
              Internet access to university library catalogs and indexing or abstracting services

         There are costs associated with shelf space, room space, journal binding, subscriptions, cataloging and computational support for data access.   An alternative to acquiring paper copies of journals is a subscription to electronically published and distributed journals. The field of professional librarianship offers expertise in the form of journals, monographs and consultants who can assist a FSML with determining the appropriate level of library operation and expense to serve users.

      b. Staffing

         Library staffing can range from some volunteer time, to part-time secretarial help to full-time professional librarians and assistants. FSMLs may be able to obtain advice

and support from campus libraries. Universities with library science degree programs may have students who need to perform internships. Cooperative arrangements with other libraries may provide internet access to digital versions of journals, citation search engines (Biosis, SCISearch), interlibrary loan, etc.

c. Facilities

There are a number of specialized storage requirements for library materials. The advent of compressed shelving makes having a library in a small space much more feasible. Storage of some materials, especially archives, may generate specific requirements for temperature and humidity control.

d. Policies

i. Lending, loaning, depositing and disposing of library materials
Often the material at FSMLs is only available for use in the library and is not checked out, particularly at small field stations. At larger FSMLs there may be reading rooms, etc. where the material can be checked out if there is staff available for monitoring. All materials that are deposited in the library should be given to a designated staff person in order to minimize chaos. Donations of journals should be controlled through accurate record-keeping of who donates and when each issue is acquired. The exception to controlling lending and depositing is the unmonitored free-for-all paperback lending library.

Many FSML libraries exists solely because of the generosity of donors providing journals and books. However, some gifts are of only marginal utility. Someone within FSML administration needs to have the authority to accept or reject library donations. Additionally, there should be a written policy for deaccessioning materials. Some books and journals are decades old and cover a span of only a few years, and would better be given to a large university science library than taking up important space at a FSML. These difficult decisions need to be made from a well considered written policy agreed to by donors, users and administrators of the FSML library.

ii. Copies of theses, dissertations, coursework papers and scientific papers
A bound copy of any thesis or dissertation based on field work conducted at a FSML should be deposited with the station.   Students and visitors should be advised of this requirement to provide copies.   Additionally, an archive should be created of any papers resulting from coursework projects.

iii. Bibliography and repository of publications
FSMLs are encouraged to compile a bibliography of all publications resulting from work conducted at the FSML. At least two copies of journal articles as well as other printed materials resulting from work at the FSML should be provided to the Director or the library. Compliance with this requirement should be a condition of continuing to work at the FSML. The cumulative body of knowledge about the FSML that results from these studies is of great importance to future scientific users.

iv. Donations of books
There is a cost associated with storage of books. For public relations reasons, donations should be encouraged, but some selection of donated material is required. A letter acknowledging a gift of books or journals that meets IRS

requirements for charitable donation substantiation should always be provided to the donor.

2. Collections

    a. Issues

        i. Databases
        For each collection of items, a database should be prepared. A wide range of collection database software is available. Most FSMLs with collections would benefit from developing partnerships with museums and following museum protocols such as those established by the American Association of Systematics.

        ii. Legal issues – permits for collection and possession
        Usually regional, state and federal permits are required to collect plants and animals, even if they are not listed as threatened or endangered species. Researchers should provide copies of current permits with the FSML research application forms. Often a FSML provides list of contacts in appropriate government agencies to facilitate the permit process. In some cases, it may be possible for a FSML to apply for a general permit to cover all research and teaching activity admitted or approved by the FSML. Some states require that either original permits or copies of permits be in the physical possession of collectors when they are collecting. Old specimens at FSMLs may now require possession permits. Examples of likely materials include eagle feathers, skeletal remains of native peoples, etc.

    b. Staffing
    Keeping track of new collections and materials to be lent can require a great deal of staff time. Collaboration with regional museums and herbariums should be developed. Perhaps volunteer labor for preparing or cataloging specimens can be found through internship programs.

    c. Facilities
    Facilities to store plants, animals and other specimens can be very expensive. Before committing to storing samples, a FSML should develop a long-range plan for space allocation and maintenance expenses. Tissue, soil and other collections may require expensive storage in ultra-cold freezers that require continuous electric supply. Formalin and other fluids used in collections may require special building permits and fire prevention structures. There are a number of references available describing how to store various types of plant and animal materials as well as soil, air and water samples. The proper storage of scientific collections can be very expensive and highly technical. Many FSMLs are unable to provide adequate storage opportunities for individual scientists and suggest that home institutions might be more appropriate venues to meet specimen storage needs.

    d. Policies for lending, loaning, depositing and disposing of specimens
    Similar to the situation for library materials, policies need to be developed and understood by all with regard to how collection materials are used. Specimens need to be tracked by staff if they are to be removed from the storage facility and loaned to scientists or other institutions. Policies should be developed for acquiring specimens and for removing them from the collection.

3. Information Management and Computer Facilities

a. Issues

i. Cost
Costs associated with computing and information management can be significant. For FSMLs, several good reviews exist. The issues were defined and documented extensively in the workshop summary "Data and Information Management in the Ecological Sciences: Synopsis from a Field Station Perspective" (Swain and Michener 2000). The full report, called "DIMES", is also available (Michener, Porter and Stafford 1998).

ii. Connectivity
Connectivity is a very quickly evolving landscape of options. Costs are dropping and satellite technology can soon deliver good connectivity almost anywhere. FSMLs should contact their supporting institution or the OBFS liaison at the LTER office for the latest options. Often university or other sponsoring institution connections can be extended to FSMLs at reasonable costs. Independent FSMLs might investigate the possibility of securing connectivity through a nearby university or public agency.

iii. Power and lightning protection
Issues relating to the determination of power sources for computing systems are discussed extensively in the DIMES report. It is particularly important for FSMLs to have uninterrupted power supplies attached to their computers and other equipment to minimize damage associated with electrical voltage fluctuations. Some of the best lightning protection at field stations is installed at Archbold Biological Station in Florida. The Archbold system was partially funded by NSF and details about the system are available directly from Archbold staff.

iv. Maintenance and replacement
The average lifetime expectancy of a computer, either desktop or laptop, is three to five years. Budget plans should reflect limited period of utility. Short lifetime also apply to servers, hubs, routers and other network components. Printers and other peripherals may have even shorter lifetimes.

v. Information back-up
Administrative and research information at a FSML should be backed up on a regular basis and stored in two or more locations, ideally with one off-site.

vi. Functions
There can be a wide range of hardware and software at a FSML. Resources can be as basic as one PC for administration with a 56K modem on a single phone line, or as complex as a network across all the FSML facilities, an elaborate GIS lab, and fast internet connections. More elaborate systems will require some professional information technology assistance on the site as well as sufficient building space and bandwidth. It is difficult to define a minimum installation for a FSML, but the ability to provide e-mail and web access is reasonably important. The ability to grow can be severely constrained by limited bandwidth availability.

vii. Audio visual resources
Basic audio visual resources at a FSML used to include simply slide or overhead projectors and an array of computer printers and photocopiers. Today, digital photography, use of a laptop computer and a digital projector of at least XVGA quality can all greatly improve the teaching and outreach capacity of a FSML. As more outreach goes online, images from websites and digital projectors can

be shared. By skipping the processing of film slides, presentations can be quickly assembled and shared over the internet.

viii. Distance learning and conferencing
Distance learning opportunities are embraced philosophically by some FSMLs and rejected by others. Issues to consider include the ability to reach a wide audience versus the fundamental experience gained by being outside in the field. The debate is moot for many FSMLs, however, because both distance learning and conferencing capabilities require at least partial T1 bandwidth, or at two 156K ISDN phone lines.

ix. General principles
Here are some general principles that result from direct experience at FSMLs:
- It often pays not to be at the cutting edge of technology. For example, the latest release of a software or hardware product is often rife with bugs or other problems. Furthermore, cost is at a premium for the cutting edge product. Compatibility is often an issue. Sometimes the most recent version of software is not compatible with earlier versions. However, being more than a year out of date can reduce effective communications with other scientists at other institutions.
- It is better to err on the side of more frequent back ups.
- Ease of use, access to service, and customer support are high priorities in purchasing hardware and software, particularly at remote FSMLs. It is better to purchase off the shelf, integrated components as opposed to on-site programming and fabrication.

b.   Staffing

It is important to establish how much staff time can be allocated to support the information management needs of either visiting scientists or FSML research and administrative staff. Often considerable effort is involved in just maintaining basic infrastructure. Software updates generate a continual demand for time and support, but are necessary to keep up with the larger research community. At many FSMLs, anywhere from 10-25% of the research budget must be allocated to computing and communication support. Additional staff time must be spent consulting with visiting and resident researchers and staff to confirm the nature of information management needs over time.

Many FSMLs begin with a half-time position dedicated to information management, and let the need drive the increase in staff allocation. Funding can be derived from research or station fees, or indirect cost recovery mechanisms. Managing administrative and scientific information is not an optional activity at a FSML, but rather is a fundamental and integral part of FSML administration.

c.   Facilities

Facilities can range from a single PC with a modem to a local area network linking dozens of computers to the internet. The greater the investment in computer hardware, the greater the need to invest in lightning protection, uninterruptable power system and related infrastructure and support staff.   It may pay to have a private consultant work with new FSMLs or with FSMLs contemplating upgrades of computers and computational network infrastructure. For example, fiber optic networking requires specialized equipment and tools. A great deal of expertise is

available to FSMLs from the OBFS liaison position at the LTER central office at the University of New Mexico in Albuquerque.

d. Policies

    i. Providing consulting expertise
Each FSML should develop specific policies regarding how much FSML-paid information management staff time is allocated to consulting with staff and visiting researchers. Perhaps fee-based consulting can be provided within the FSML to help offset other information management expenses.

    ii. User fees
Many FSMLs have found that a reasonable fee for visiting researchers to provide access to e-mail or the internet is acceptable (eg. $20/user/month). Several FSMLs embed this expense in fees for general access to station facilities. Fees should reflect costs for internet access, telephone billing, etc. Additional fees may be necessary to cover supplies, media, etc. Using locking software to limit one or a few workstations to only e-mail, telnet and browsers can greatly reduce staff time to maintain computers and monitor usage. Often visiting users are unaware of how much more it costs in rural areas to secure connectivity. Internet service providers in rural Colorado, for example, pay nearly four times what ISPs in Denver pay for phone line availability.

    iii. Software installation
A policy needs to be developed to prevent violation of copyrights of software on multiple machines. Installed software cannot be copied or downloaded onto other machines. The FSML as the "umbrella" organization bears the burden of violation prevention and must have a written policy in place to minimize liability exposure to copyright lawsuits.

    iv. Virus protection
A policy should be implemented to install virus protection on all machines and update virus definitions on a regular basis. Web-updated virus protection software is ideal for FSMLs.

    v. Access
A policy addressing access to computers, information databases and networks should be developed by every FSML. The terms of the policy will depend on FSML size, staffing and facilities. In many cases machines, software and data files can easily be password protected. Expertise is available to FSMLs from the LTER main office.

    vi. Data sharing
Each station should have a clear policy on data ownership and data sharing. There are emerging rules concerning the sharing of data collected with federal research grant funds. The LTER office can provide the most recent information.

    vii. Data catalog
OBFS is developing a process whereby a brief summary of each data set developed at every FSML is compiled for an OBFS data catalog. The National Association of Marine Laboratories (NAML) is also addressing institutional data sharing. Each FSML should develop a policy to encourage all scientists and students to catalog their data sets.

    viii. Data repository

Over time, it may be useful for FSMLs to archive copies of raw data and metadata (Michener et al. 1997). Each data set should be described in the FSML data catalog.

ix. Citation policy for data use
FSMLs should have a policy stating that all publications will provide adequate acknowledgment of station support and complete citations for any FSML data used.

x. Back-up and archiving
FSMLs should have a policy mandating backing up and archiving administrative and research data. Ideally, data should be backed up frequently and at least one copy stored off site.

B. Research

1. Issues

a. Research resource allocation
FSMLs need to determine the relative allocation of resources to researchers from the sponsoring institution and visiting researchers from other academic institutions. FSMLs should recognize that the National Science Foundation tends to decline funding requests from FSMLs that do not show significant use (undefined, but approximately more than 25%) by the broader scientific community beyond the sponsoring institution. Many FSMLs are strongly supportive of extensive use of their facilities by outside researchers because of the cross-fertilization of ideas that occurs in a diverse research community. Procedures should be developed to allow decisions about resource allocations to researchers when demand for housing, labs, research sites and other facilities exceeds capacity.

b. Manipulative or non-manipulative research
FSMLs need to define which parts of the land under their influence or management shall be dedicated to manipulative or non-manipulative uses, recognizing that manipulative uses of the land may preclude other future ecological or genetic studies. All manipulative studies should be mapped so that future research conducted on previously manipulated sites can consider effects of past manipulations. If manipulative studies are conducted, plans should include some long-term markers for the manipulated sites. Also, the manipulated sites should be surveyed with GPS and entered in a GIS. Paper maps of manipulated sites can be archived as well.

c. Zoning of lands
Zoning allows stations to provide a variety of exclusive and non-exclusive uses of land under their management or influence. Each station should develop a map that is clearly understood by all which shows places that can be used by the general public, by teachers and students, lands exclusively used for research and land that can support combinations of public, teaching and research. Additionally, there should be a functional mechanism that makes it easy for researchers to mark their study plots on the map each field season. Annual updating of research sites maps should be required of all scientists and students at a FSML.

d. Long-term or short-term studies
Long-term studies can preclude the use of some land for other uses, potentially for a very long time. All long-term studies should be clearly mapped and marked so that future researchers using that land understand where the previous studies have been conducted, and what associated historical data may be available. If long-term studies

are conducted, plans should include some long-term markers for the research sites. Long-term study sites should be surveyed with GPS and entered in a GIS. Paper maps of long-term sites can be archived as well.

e. Use of public lands
FSMLs may have cooperative use agreements or informal use agreements with a variety of private, state and federal lands. Each FSML should encourage a cooperative effort in tracking research with appropriate land management and resource management agencies. Formal agreements can be negotiated and working groups formed to include representatives of landowners and land managers for the geographic area of shared research interests.

f. Type of research program
Most FSMLs host research conducted by scientists at a variety of stages of professional development. These levels include projects conducted by high school students, undergraduates, graduate students, professional scientists, and public agency personnel. Each of these levels involves relatively less or more supervision from the FSML administration. Other administrative implications include who is responsible for research behavior (eg. a minor cannot legally sign an agreement to abide by a research code).

g. In-house grants, cost sharing, student support
FSMLs can provide in-house grants, cost-sharing and student support if funds are available. Even small amounts of money can make a huge difference to the success of undergraduate or graduate student research efforts. FSML grants can be used to encourage different elements of the overall research programs, if certain areas need bolstering. For example, grants could be provided to continue annual stream water monitoring efforts by independent graduate students. A postdoc position could be awarded to initiate a watershed monitoring program involving undergraduate research interns. If the sponsoring institution awards grants, it could consider providing the FSML with housing and facility maintenance costs to defray the operating expenses incurred by those who are awarded such support.

h. Focused research themes versus general research programs
FSMLs will need to determine the degree to which the station will support a wide diversity of research topics. These research program issues should be addressed through an ongoing planning process. For example, it is possible for a small group of scientists in a relatively narrow field of study to make a long-term commitment of lands to manipulative study thus precluding many future opportunities for more diverse research uses.

i. Compatibility of research projects
Consideration should be given to the nature of proposed research and its impact on other current research projects. For example, a study that proposes to introduce a population of honeybees or another pollinator would be devastating to long-term studies of plant-pollinator interactions in the same area. As more applied projects are conducted at FSMLs, issues of compatibility with observational science will become more contentious.

2. Staff

a. Stations without research staff

Many FSMLS only have staff who facilitate the research efforts of others, not staff who conduct research. Providing facilities for visiting research can require housing

interns, technicians, scientists and families and providing laboratories or other resources for these research teams.

Often a FSML creates a part-time staff position called "Research Coordinator" to focus on addressing the many needs of visiting research programs. For example, a large research group wishing to work at the FSML may develop a grant proposal for submission to a funding agency such as NSF. A staff member of the FSML should review the proposal at an early stage so that compatibility of the research, housing and other facility needs of the research program are addressed well before the project is funded. Once funding is received, an obligation has been created on the part of the FSML to provide the necessary resources for the length of the project.

b. Stations with research staff

FSMLs with in-house research programs (hereafter called sponsored research) will need to determine the relative allocation of resources their scientific staff. Any funding received by sponsored research programs generates an expectation that the necessary resources required to conduct an effective research program will be provided to the scientific staff. They will naturally assume that they have the highest priority for space allocation.

3. Facilities

a. Facility development

Decisions about facility development should be based on a plan that considers long-term carrying capacity in the context of the mission, vision, goals and objectives of the FSML. In the context of a facilities plan the relative allocation of space and other resources for research, education and outreach can be addressed.

b. Facilities needed for different research programs

Many different research programs can be pursued at a FSML. It is easy for some research users to share spaces with other programs, but other programs require segregated facilities. A recommended parameter when considering how to allocate research resources is to ask how the program in question affects other people. Is it a nocturnal research project? Will there be 10 people preparing samples in a lab at late hours, playing music while they work? Will soil samples be heated, generating offending odors? Are *emeriti* researchers who spend hours writing in their office being asked to work next to a large, noisy lab with many undergraduates coming and going? Does a research team need to be near outside faucets, greenhouses, controlled plots, animal handling facilities, etc? All of these issues will arise later in the midst of a hectic field season. Careful consideration in advance when planning space assignments can make everyone much happier.

Another facilities question is the degree to which staff from sponsored research projects can share resources with visiting researchers. This issue may be difficult to resolve, because in-house staff are in their labs daily and use resources regularly, while visitors come and go and may not be as knowledgeable about nor careful with research equipment. On the other hand, the mixing of scientific staff with visitors creates a synergy that is one of the most productive attributes of science conducted at a FSML. Thoughtfulness and consideration on the part of the FSML will go far toward minimizing potential conflicts.

c. Animal holding facilities

A FSML should decide whether animal holding and manipulation will be permitted. Most FSMLs feel an obligation to provide this service for research users of their facility. The U.S. Department of Agriculture regulates animal holding for research and teaching purposes. The local USDA officer should be consulted when planning animal facilities, because s/he will have to inspect the FSML animal facilities for compliance with federal regulations. The scientific societies have developed protocols for handling regulated species for field and laboratory experimentation. FSMLs with animal handling research projects can choose to admit those projects themselves and assemble an animal welfare committee in compliance with USDA regulations, or they can require that every researcher provide evidence of compliance with their home institution's animal handling procedures.

4. Research Policies

FSMLs need to develop a variety of policies relating to research programs. Consideration should be given to how research users at FSMLs are included in planning efforts that lead to policy formulation. Types of research policies that will be required at most FSMLs are listed below:

a. Facility allocation

Each FSML should develop policies and procedures for allocating station resources for both the short- and long-term. It is especially important to be prepared for how to respond to a greater demand for research space than can be accommodated at the FSML. Consideration needs to be given to resource needs for long-term baseline monitoring studies (meteorological, permanent vegetation productivity plots, mapped forest stands, etc.), short-term research projects (individual and small-group, 1-3 year projects, extramurally funded, Master student projects, etc.), and collaborative large-scale studies (e.g. National Acid Deposition Program, phylogenetic studies, etc.)

b. Research fees

FSMLs should develop procedures for setting fees that will assist with recovering operational costs associated with research use. Examples of fees include laboratory rental, station use fees, computing fees, overhead charges for grants run through the FSML, etc. Some FSMLs embed these fees in one overall charge and others allow extremely detailed itemization. The mechanism for collecting the fees and sanctions for nonpayment should be articulated in a manner that every user must read and abide by. Some FSMLs convene a laboratory management committee to address conflicts concerning user fees, scheduling issues, etc. for research facilities.

c. Research codes

Many FSMLs have a research code that governs research conduct. The code usually evolves from a mater plan and specifies what kinds of research are allowed at the site. Restrictions on research topics (e.g., non-native species/genes, transgenetics, etc.) are listed. Priorities for space allocation are stated. Expected standards of behavior are articulated. Requirements such as registering research plots on a map, providing copies of all necessary federal and state permits to the FSML office,

depositing raw data in the FSML information archive, depositing voucher specimens in the FSML collection, depositing any publications resulting from research conducted at the FSML in the library or administrative office, etc. are listed in the research code. Usually researchers must sign that they have read the research code and agree to abide by it as part of the FSML application and admission process.

    d.   Research application and review process

FSMLs usually develop a formal application process that includes a form to capture information on users (name, contact information, sponsor, funding amount, duration, facility requested, land requirements, proposed locations, etc.). The application requires that users read and agree to the FSML research code. Proof of federal and state permits is often required at the time of application. Mention of any hazardous materials is required. Animal care and use applications may need to be appended, or evidence of animal protocol approvals from home institutions may need to be provided. Decisions on research project approval should not prevent or impair the future value of the FSML as a natural system, unless there is a conscious desire to make significant changes.

Formal approvals of research projects need to be specific as to their extent. Is the project admitted for three years? Five years? Forever? When is a new application required? What facilities are promised to the research project, for how long a time?

    e.   Termination of research projects

FSMLs should develop policies and procedures to ensure that all research materials are removed at the end of a field study. Some examples of materials often left behind include hazardous chemicals, rebar, PVC pipes, trailers, fences, flagging, wires, sensors, etc. Securing compliance with material removal requirements is very difficult and will require attentive administrative staff. In the most egregious cases, granting agencies such as NSF can be notified.

C. Education

  1. Planning

Planning efforts provide an important context for considering which educational programs are appropriate to a FSML. Plans should:

- Articulate a vision statement for FSML education and training.
- Assess strengths, opportunities, weaknesses and challenges.
- Determine appropriate categories and scales to be included in the definition of "education" programs.
- Evaluate the role of the FSML in each of the contemplated educational activities. For example, will the FSML conduct the program? Simply host it?
- Develop programmatic guidelines for time and resource allocation.
- Identify funding resources.
- Associate timelines with various projects.

  2. Program scales to consider

a. Undergraduate education
The role of the FSML in undergraduate educational offerings should be defined. This role can range from merely offering a site for visiting classes, to sponsoring a full range of undergraduate courses from the sciences, arts, humanities or other disciplines. The level of facility use can vary for each type of undergraduate program. Uses include being a field trip destination, providing space and resources for resident courses, supporting independent studies and summer projects, participating as a required curriculum component for some majors, or providing research training in the field. Priorities will need to be determined for the variety of programs offered, and also for the source of the program (home institution, consortium members, other colleges or universities, etc.)

b. Graduate education
Many FSMLs provide facilities for graduate students to undertake thesis or dissertation projects. Sometimes the student's major professor is not in residence, and the student is an independent researcher. Formal FSML educational offerings at the graduate level include specialized seminars and training in specific advanced field or lab techniques.

c. Pre-Kindergarten – 12 (PreK-12)
Consider the definitions of education that are appropriate for the FSML. Some less formal PreK-12 programs are considered to be outreach programs. The role of the FSML in formal PreK-12 education should be carefully defined, since these programs can easily come to dominate the daily life of a FSML. Roles can vary from a partnership with school districts or individual schools, to curriculum development, to providing natural resource case studies for already established programs (Riverwatch, Project Wild, etc.), to providing a field trip destination, or to facilitating a weekend outdoor experience. There are also opportunities to receive NSF funding for providing high school students with research training opportunities.

d. Teacher training
FSMLs host teacher training programs at a number of levels. These include providing specialized training for college or university faculty, often related to new field science techniques that can be adapted to undergraduate teaching or research labs. FSMLs also participate in PreK-12 teacher training in conjunction with Schools of Education. A third category of teacher training is providing opportunities for teachers already in service to expand their knowledge. There are a number of funding opportunities at NSF for teacher training at all of these levels. FSMLs can also participate in programs such as Project FIRST (see link on the OBFS home page).

e. Public education
This category includes activities that are generated by a public school system, or in partnership with one. Activities that are solely generated by the FSML in order to inform the public about FSML activities are usually categorized as "outreach" and are discussed in the following section. There are a number of opportunities for FSMLs to participate in public education, such as:
- Natural history tours (partnering opportunities)
- Interpretative programs (docents, community ambassadors)
- Public workshops, training (e.g. bird ID, medicinal plant use, plant pressing, papermaking)
- Volunteer activities (e.g. stream restoration, exotic removal, monitoring, plant propagation)

Many FSMLs enter into these activities to generate some revenue, and find they are ultimately overwhelmed with requests to accommodate school groups. A careful watch should be kept on what percentage of FSML resources are devoted to participation in public education, since conflicts with research use of space and facilities are common.

    f.   Resource management professionals

A number of FSMLs have developed seminars or workshops for professionals who manage resources at public agencies or for large corporations. These seminars can be quite lucrative, but require a significant expenditure of administrative effort. Issues to consider include determining the role for the FSML, the nature of partnerships and how they are formally constituted, responsibilities for marketing, and responsibilities for curriculum content. Successful workshops include focused efforts addressing reasonably specific local or regional natural resource needs. There are also opportunities to provide professional certification and training in research techniques such as water quality monitoring, bird-banding, etc.

3.   Staffing

There is an infinite array of staffing configurations for FSML education program. The first step is to identify the role and responsibilities of the FSML in each program, based on FSML priorities and funding resources. Who provides instructors? Who develops curriculum content? Who coordinates educational programs? Who gives tours or intercepts program participants in other ways? Who markets the programs? When programs evolve from partnerships with other entities, it is especially important to articulate these roles clearly.

Identify strategic projects that have clear timeframes and expectations. Differentiate between short-term and ongoing programs. Define roles for short-term staff projects. Roles include:

Title	Status	Responsibilities
Academic Program Coordinator	Full time/Part time Staff Position	Coordinate research and educational user community, administration, provide proposal support
Reserve Manager	Full Time/Part Time Faculty Member	Facility management, public relations, research liaison
Scientific Staff/Faculty	Adjunct Faculty, Instructors	Conduct biological research, publish, teach graduate students, obtain extramural funds
Environmental Education Specialists	Contract, Short-term	Develop and implement an environmental education curriculum
Volunteers	Temporary, Unpaid	Docents, Teacher's Aide
Volunteer Coordinator	Contract, Short-term	Coordinate Volunteers, Events

4.   Facilities

Educational facility needs should be integrated with long term programmatic objectives. Identify appropriate facilities and land resources for each type of educational program. For example, resident courses will need housing, dining facilities and classrooms.

Resource management professionals will need conference room facilities. Natural resource interpretation training may use trail networks, restoration sites and disturbed areas for reference comparisons.

a. Space considerations for education and training programs include:

- Classrooms (smart classroom, AV access)
- Teaching labs (wet lab, darkroom, mud room, etc.)
- Computer facilities (machines, LANs, GIS)
- Library facilities, electronic access
- Study areas, conference areas
- Recreation, informal gathering areas
- Public interpretative areas, displays
- Food service facilities
- Overnight housing/dorm facilities
- Campout facilities

b. Equipment considerations include:
   i. Whether equipment is provided by the FSML or brought by visiting faculty or researchers
   ii. Whether equipment is site-specific or shared open-access equipment. Lab equipment that can be shared includes TEM, spectral photometry, analytical genetic equipment, etc. Field equipment that is open-access but site-specific includes various arrays of tower instrumentation.
   iii. Spatial configurations, such as the proximity of educational facilities to research labs, quiet areas, housing, roads, etc.

5. Policies

FSMLs usually develop a number of policies relating to educational programs. Careful and comprehensive advance planning for programs will help avoid the many crises that seem to arise on a daily basis during a busy field season.

a. Policies governing the development of facilities
   Siting of buildings, land use plans, appropriate locations for different teaching activities, master development plans approved by local government, etc. are among the policies that govern facility development. All of these policies should sustain the core values of the FSML relative to its mission. Are interactions between user groups to be encouraged or discouraged? Is the general atmosphere to be quiet and serious or recreational?

b. Policies governing the use of facilities
   Applications for each type of program should be developed. Each application will be tailored to the nature of that program. For example, a request to use facilities for class research projects on weekends might include requests for the number of students, the name of the instructor, the responsible department or other entity, a list of use fees, an agreement to provide products such as student papers resulting from the program, requirements for documentation-sharing with the FSML, a listing of site use priorities, statement of animal care policies, etc.

c. Codes of conduct
   A number of FSMLs request students participating in educational programs to sign codes of conduct. Make sure the signatures are legal, i.e. with a parent or guardian signing for students under 18. Also, make sure that disciplinary action that might be

taken if the code is violated is stated in writing and includes a description of the disciplinary process.

d. Policies for instructors
Instructors conducting educational programs at FSMLs need to be apprised of appropriate field behavior. Some FSMLs use their research code for this purpose, and ask that instructors sign it. Issues to be considered relate to manipulative experiments, collections, transgenetics, introduction of species, appropriate locations for research plots and large equipment (greenhouses, tanks, screen rooms, etc.), hazardous material use and disposal, permits of all types, and any government requirements at the local, state or federal level.

e. Procedures
Procedures for educational programs should be clearly defined in order to implement apply the appropriate policies. Project-based procedures will provide tracking, timelines for development, implementation, documentation and closeout processes. Teaching classes will involve not only the project-based procedures, but also an awareness of daily schedules, access to vehicles, knowledge of which FSML staff can assist, etc. It is important that communication be as direct and comprehensive as possible. Program participants need to be forthcoming about the procedures their program will involve, and FSML staff need to be explicit about expectations for adherence to various FSML policies.

D. Outreach: Public Relations, Community Relations and Professional Service

"Outreach" has many definitions. It is important that the FSML's definition of "outreach" matches the definition of "outreach" used by the sponsoring institution or funding source. NSF defines education as the transfer of scientific information. Transferring information to the general public is usually considered outreach.

If the FSML is a land grant institution, an extension component is often considered "outreach", as can be K-12 activities. Some public professional activities of FSML administrators or staff (e.g., Board of Editors, Scientific Staff for Multiple Species Conservation Planning) may be important parts of a FSML program.

A vision statement for outreach activities should be developed as part of the master planning process. Determining the nature and extent of outreach activities appropriate to the FSML will involve an assessment of strengths, opportunities, weaknesses and challenges. Evaluate the proposed FSML role and identify appropriate categories and scales to be included in outreach. Build programmatic guidelines for time and resource allocation. Use planning tools like the effort-return matrix. Identify clear funding resources and timelines associated with various scales and projects.

The desired return from outreach activities should always be weighed against the effort of time and expense involved. Many outreach activities involve great expenditures of effort for little potential return. Note that the benefits can be enhanced by making sure the names and contact information for all public participants in FSML activities are captured. It is remarkable how often this small task is ignored, and there are potentially huge benefits to fundraising and other support opportunities.

1. Scale of Outreach Activities

Here is a list of examples of outreach activities at FSMLs. The scale of the program can be simple and involve little expenditure of time or funds, or it can be quite large and complex.

    a.   Public reception – create an easily located reception area and staff it so as to impart information about the FSML cheerfully, yet control general public access in the manner appropriate to the specific FSML.

    b.   Media liaison – either tracking content or creating content for TV, radio, newspapers.

    c.   Develop marketing and recruitment strategies for FSML programs.

    d.   Service organizations – provide canned slide shows and other talks, host Eagle Scout projects, talk to Scouts, the Elks, Nature Centers, Garden Clubs, etc.

    e.   Local conservation organizations – provide speakers, host tours or workshops.

    f.   Lecture series – create a lecture series for the public.

    g.   Local and state government - serve on advisory committees, maintain appropriate relationships with elected officials.

    h.   Federal government - serve on advisory committees, maintain appropriate relationships with elected officials, provide scientific expertise for national initiatives.

    i.   National scientific organizations - serve as expert, editor, reviewer or committee member.

    j.   Host regional, national or international scientific conferences.

    k.   Technology transfer – provide advice about the application of basic science.

    l.   Public tours of FSML property and activities.

    m.   Virtual tours - web cams (See: http://www.jamesreserve.org).

    n.   Community days - participation in clean-up events, Earth Day activities, local parades.

    o.   Schmoozing activities – lunch w/ donors, neighbors, cocktail parties (hosting / going), get-togethers, friendship-building and awareness-raising.

    p.   Liaison with home institution key figures – invite to the FSML and get to know on campus the staff from the public relations office, the media office, the development office, the campus relations office, and other key faculty and administrators.

    q.   Host retreats for university departments, corporations, public agencies and others.

2.   Staffing

When staffing outreach programs, identify the critical programmatic goals and direct staff and volunteers so that staff are engaged in highly productive efforts. Recognize that

there is great volunteer potential for many outreach programs, but volunteer supervision is time-consuming.

Issues to consider when staffing outreach efforts include:

a. Identify appropriate staff for public relations and tours.

b. Coordinate with public relations, development, media and legislative relations personnel at the sponsoring institution. Some of these functions may be entirely handled by these departments, obviating the need for FSML staff. In that case, regular communication of FSML needs, and effective monitoring of and feedback regarding institutional efforts are duties that must be assigned to FSML administrative staff.

c. Provide staff for coordination of volunteers.

d. Identify the level of service activity and desired outcomes of involvement for FSML scientific experts (committee meetings, science panels, advisory groups).

e. Recognize opportunities for technology transfer and desired outcomes of involvement for FSML scientific experts.

f. Assign a point person for information flow in and out of FSML. Duties would include generating template letters, providing canned descriptive material, tracking outreach effectiveness, etc.

g. Assign staff for event planning and coordination.

h. Identify strategic projects that have clear time frames and expectations. Differentiate between short-term and ongoing programs. Define roles for short-term staff projects.

i. Where appropriate, capitalize on FSML education and research programs. Coordinate these programs with outreach activities for added value.

j. Determine the proportional allocation of staff time to outreach.

k. Decide which voice speaks publicly for the FSML and don't deviate. Staff can give tours, answer questions, and interpret programs to the public, but position statements and policy determinations should come from a high administrative level within the FSML. For example, in public hearings regarding adjacent land use changes, only one voice should provide the official FSML position.

3. Facilities

Developing facilities for outreach program requires careful planning. Some of the issues are:

a. Public use of roads, trails, parking.

b. A public intercept space, such as a reception area.

c. Creating nature trails, board walks, kiosks.

d. Signage. Note that there may be local regulations about signs.

e. Gift shop or other area for retail sales.

f. Access to a museum or interpretive area.

g. Gathering spaces for socializing, with amenities such as good views, a fireplace, barbecue area.

h. Core values – ADA compliance, green materials, appropriate technology, fire safety, low water use.

i. Local zoning regulations and access issues.

Some FSMLs build a nature center in an area away from active research areas to accommodate most outreach programs. Boardwalks can also minimize the impact of public visitors on research areas.

4. Policies

a. Develop and maintain a communication system with the sponsoring institution's key administrators to share information regarding outreach activities (e.g. observe university protocols for contact with elected officials).

b. Develop policies relating to liability and safety, such as a response time policy for emergencies in conjunction with fire or ambulance services.

c. Develop policies relating to the compatibility of recreational activity with FSML programs.

d. Develop policies regarding the amount and type of public access.

e. Develop application procedures and behavior expectations for all users.

f. Create a tracking system for outreach activities so outcomes can be determined. It should be FSML policy to evaluate the effectiveness of outreach activities. Otherwise they become a black hole for time and money, generating expectations over time that cannot necessarily be met.

g. Develop a policy for follow-up and thank-you procedures.

E. Social Interactions

FSMLs often become communities of people with shared educational backgrounds and expectations. Especially when they function as a remote "campus", collegial relationships of the residents can be enhanced through some facilitation of social interactions. A specific policy for FSMLs to encourage social interactions could be developed or at least recognized in the planning process.

FSMLs should encourage the development of social interactions across social strata. This can be done in a number of ways. FSMLs could organize discussion groups for ongoing research and education, or have weekly or more frequent informal opportunities for the FSML community to meet. Actual examples from FSMLs around the country include wine-tastings, barbecues, musical concerts, coffee houses, afternoon teas, golfing tournaments, knitting

clubs, language groups, no-talent shows, and sweat lodges. Some of these events can be open to the neighbors of the FSML and to interested stakeholders.

Extensive formal facilities are usually not required to promote the social atmosphere at a FSML. However, recreational areas such as volleyball courts, horseshoe pits, barbecues, decks and porches, fireplaces, ramadas, or a student lounge should be considered in the facility planning for the FSML.

Tables, Figures and Documents for Section III – Program

Examples (fill in list as examples are provided):

III.   General Program Policies
III.A.1. Library Staffing, Policies, Facilities
III.A.2. Collections Staffing, Policies, Facilities
III.A.3. Information Management and Computer Staffing, Policies, Facilities
                    LTER Data Sharing Policy *(Source: W. Michener, LTER Network)*
III.B.   Research Codes, Applications, Lists, Facilities, Policies, Fees
                    Research Use Application *(Source: M. Stromberg, Hastings Reserve)*
III.C.   Education Programs, Policies, Applications, Forms, Fees
                    Class Use Application *(Source: M. Stromberg, Hastings Reserve)*
III.D.   Outreach Programs, Policies, Applications, Forms, Fees