

November 2010

Management Plans from a random selection of 8 LTER sites recently renewed (ARC, BNZ, FCE, HBR, KBS, MCM, NWT, PIE)

Arctic (ARC)

SECTION 3: PROJECT MANAGEMENT

Overall management structure: Arctic LTER research spans a broad spectrum of researcher backgrounds, skills, and interests. For efficiency and to promote effective planning we have organized into four groups, each focused on major components of the landscape, i.e., terrestrial, streams, lakes, and “landscape interactions” (Fig 3-1). This structure has proved highly effective for planning and project management, especially manipulations of lakes, streams, and tundra. Over the next 6 years we plan to add a fifth component, Human Dimensions.

An Executive Committee (EC) consisting of the lead PI (currently Hobbie), representatives of each research group (currently Shaver, Bowden, Luecke, and Kling), and one additional person (currently Giblin) meets at least twice a year, once in the fall and once during a winter plenary meeting of all project personnel. The purpose of the fall meeting is to review the previous summer's work, review the current state of the project's budget, and begin discussion of any changes in priorities, funding allocations, or new opportunities that might emerge in the coming year. At the fall meeting we also set the agenda for the winter meeting and choose a theme. At the winter meeting the EC meets before and after the plenary sessions to review the agenda, consolidate priorities and reconcile conflicts in plans developed by the four research groups, and again review the budget. Throughout the year, the EC responds to requests for information or collaboration, prepares annual reports and other communications, and interacts with the LTER Network office and with NSF. At least one member of the Executive Committee attends every Network Scientific Council meeting.

The winter meeting in Woods Hole is attended by all collaborating investigators, research assistants, and students. In addition to a review of the past year's science accomplishments, plenary discussions of project priorities are held and each of the four groups meets separately to develop plans for the upcoming summer. Each year we also invite to the meeting several current or potential collaborators as well as agency representatives (e.g., BLM). Ad hoc meetings of individual groups and of the whole project are also held during the summer, at Toolik Lake, and occasionally groups will meet during the winter.

Key project personnel include the four full-time, senior research assistants associated with each of the four research groups and a part-time assistant who works with the PI. These assistants work with the EC and the four research group leaders to do most of the day-to-day project management and coordination; they also serve as information managers within each group. One of them, Jim Laundre, is the project's senior Information Manager.

Field site management: The land where most of the LTER research is carried out (Fig 3-2) is owned by the US Bureau of Land Management (BLM), which grants permits to work there. Additional permits are required by the Alaska Department of Fish and Game for research on fish, and by the State and the North Slope Borough when working on their land. We work closely with these agencies to ensure that the permitting process runs smoothly, meeting with them each summer at Toolik Lake and (most years) at our annual winter meeting.

Toolik Field Station (TFS) is a facility of the Institute of Arctic Biology of the University of Alaska Fairbanks (UAF); it operates under lease of its land from BLM (only the 17-acre camp itself is covered). Much of the support for TFS comes through a cooperative agreement between UAF and NSF's Office of Polar Programs (OPP). Projects with NSF support, including the Arctic LTER, receive support for room, board, and laboratory costs based on the number of "user-days" at TFS. LTER scientists work closely with TFS management to ensure that research needs are met and to avoid conflicts among projects. During the summer a "Chief Scientist" meets daily with camp management to discuss immediate issues, and each summer general meetings are held with all personnel invited. LTER scientists also attend annual winter planning meetings as members of the TFS Steering Committee; M.S. Bret-Harte, an ARC LTER scientist at the University of Alaska, is Associate Scientific Director of TFS.

Collaborating projects, diversity, and interactions with LTER and other Networks

Opportunities for collaboration were a primary consideration in designing the ARC LTER research, especially its long-term experiments. Collaborating projects include those that work directly on LTER sites and experiments, and projects that use TFS facilities and collaborate in synthesis papers. Often the LTER project will encourage a particular interaction by inviting visitors to work at Toolik Lake with supplemental or core research funds, in anticipation of their eventually obtaining independent funding (an example is the project by L. Gough and J. Moore, which began with annual LTER supplemental funding). The ARC LTER project has also been successful in attracting young investigators by encouraging those who were trained at Toolik Lake as postdocs and graduate students to return as investigators with their own funding (George Kling, Sydonia Bret-Harte, Laura Gough, and Byron Crump have all followed this route). Collaborating projects are listed in the Budget Explanation.

Cross-site and Network collaborations are strongly encouraged and are supported with supplemental and core funds. Recently we contributed to the cross-site shrub comparison (Knapp et al. 2008) and the LTER TRENDS Project. Over the past 20 years a growing exchange between TFS and Abisko Field Station in Sweden has developed, involving students and investigators from European Universities; this has led to several publications, theses, and meta-analyses of responses to tundra experiments (e.g., Cornelissen et al. 2007). In the past five years we have participated in several major international synthesis activities including the Arctic Climate Impacts Assessment (ACIA; Callaghan et al. 2005, Wrona et al. 2005). Working with the International Tundra Experiment (ITEX) we have developed two meta-analyses of plant growth and community responses to warming (Arft et al. 1999, Walker et al. 2006); a third meta-analysis, of plant phenology, is currently in development.

Collaborating investigators come from 16 institutions in 12 states and are ~30% female. We also use every opportunity to promote diversity with RA and student hiring; the majority of RAs and students working with the project are women. All job opportunities are advertised nationally and those hired come from at least 15 states. The Toolik Field Station works conscientiously to hire local people including Alaskan Natives to run the Station, and our Schoolyard program (Section 5) and the nascent Human Dimensions program (Section 2) are focused on Native involvement.

Anticipated changes, 2010-2016 Our management system has worked well since 1987 and we plan no major changes. There are four issues, however, that we must deal with in the next six years. The first is the rotation of project leadership: most of the EC members have been

with the project for several decades and will be retiring in the next 6-12 years. Shaver will be taking over from Hobbie as PI in 2010, but we must begin planning now for the next transition. Leadership changes in the terrestrial and lakes groups will also occur. Within the next six years we must identify replacements for these leaders and bring them “up to speed” on management issues. Second, we must regularize and strengthen inputs from the social sciences at the level of the EC. Third, we must continue to attract new investigators with new skills and interests to the project, not only as retirement replacements but also to ensure continuing intellectual vitality and growth. Finally, TFS will become a NEON site by 2016, and we must work with NEON to ensure that this opportunity for the ARC LTER is developed effectively. We will address these issues in the following ways: First, we will increase participation in the EC by inviting additional, less-senior investigators to participate, and by including conference calls involving all investigators as part of regular EC meetings. Second, as the social science component of our project grows, by the end of this renewal period we will add it as a fifth research subgroup with EC membership. Third, to attract new investigators, each year we will support travel to Toolik Lake and to our winter meeting for 1-3 investigators with new or complementary skills and research interests. Fourth, we are already meeting with NEON to plan an effective NEON-LTER interaction. (Bowden, Hobbie, Bret-Harte, and Giblin are involved).

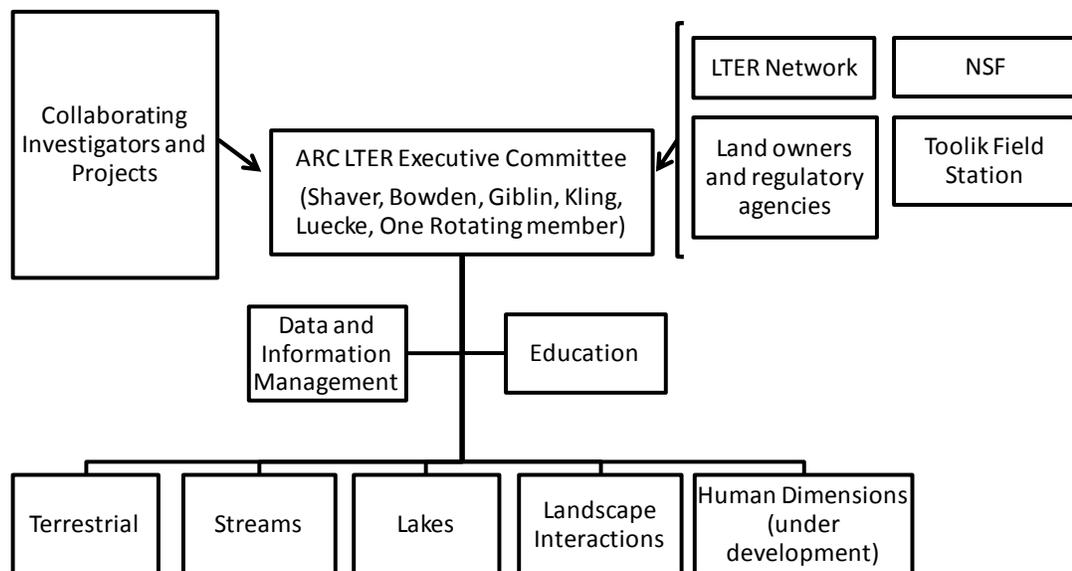


Figure 3-1. Organizational structure of the ARC LTER project. The Executive Committee manages the allocation of project resources among research, data, and education components in response to the needs of the collaborating investigators and projects. The EC also interacts with the LTER Network Office, with other networks, and with NSF; it responds to requests for information or collaboration, and it prepares annual reports and other communications.

Bonanza Creek (BNZ)

Section 3: Site Management

Leadership structure

NSF and the USDA Forest Service, through the Pacific Northwest Research Station, jointly fund the BNZ LTER project. The NSF and USFS components of the LTER program are thoroughly integrated into a single program, so we describe the management as it actually functions, rather than distinguishing between the NSF and USFS components. Our leadership team consists of the PI and co-PIs: Ruess, Jones, Hanley, Mack, and McGuire. In 2011, Teresa Hollingsworth will take over Tom Hanley's role as co-PI. Teresa is a Research Scientist at the USFS Boreal Ecology Cooperative Research Unit (<http://www.becru.uaf.edu/>), and has been co-serving as the USFS representative to the BNZ LTER for the past several years. Scientific decisions in the BNZ LTER are made at several levels:

1. Ruess serves as the PI of the LTER research program and is ultimately responsible to NSF for the overall design and implementation of the research program.
2. In practice, the five-person leadership team makes decisions jointly concerning the design and implementation of the research program. Each of us has responsibility for overseeing specific aspects of the program: Ruess, overall integration (within-site and with network) and site management; Hanley, Forest Service communication; Jones, permafrost/hydrology, Mack, vegetation/fire disturbance; McGuire, data management and modeling.
3. The LTER executive committee (leadership team plus Hollingsworth, Yarie, site manager, data manager, and student representative) meets monthly to provide feedback about major issues associated with program direction (e.g., conceptual framework and general design of this proposal). In practice, these meetings are open to all LTER personnel, and there is broad participation by the LTER community.
4. Two or three individuals are responsible for coordination and integration within each research theme: climate sensitivity (Lloyd and Verbyla), climate-disturbance interactions (Mack, Hollingsworth, Schuur, Ruess), climate feedbacks (Euskirchen, McGuire, Rupp), human dimensions (Kofinas, Kielland, Rupp).
5. There are 1-2 leaders plus a planning team responsible for designing and implementing each research task (Table 5) and for making sure that this research addresses the hypotheses and questions of the research themes and the overall project goals.
6. Each investigator is allocated a budget and is responsible for designing and implementing her/his portion of the research program (see Budget Justification).

Program integration and communication

We will continue to meet monthly to address practical issues and to plan and coordinate our within-site synthesis activities and annually at our research symposium to conduct synthesis of our major themes (climate sensitivity, climate-disturbance interactions, climate feedbacks, human dimensions). A final level of communication and integration is often facilitated by the need to coordinate transportation for travel to field sites.

Budgeting and accountability

Each PI is responsible for her/his own budget and implementation of research. Every two years each investigator must submit a progress report that includes major findings, publications, datasets that are on line or being prepared, and a mini-proposal that describes research plans for the next two years. These reports and mini-proposals serve as a basis for evaluation and budget reallocation by the leadership team. If necessary, more frequent budget reallocations will occur at the time of the annual progress report to NSF, as we have done in the past. Project PIs also obtain separate project funding to complement their BNZ LTER-funded research (Additional BNZ-related research (2005-2010) = \$38.71 million, which translates to \$7.9 per NSF-LTER \$; see Budget Justification, Table 8). In addition to budgets for each research project, we maintain separate budgets for core research, data management, and general project costs. Core research includes monitoring of climate, hydrology, vegetation, and other essential long-term site measurements. General project costs include national travel, and some infrastructure costs.

	Primary Responsibility	Secondary Responsibility
Euskirchen	CF3	CF1,CF2,CF4
Harden	D8,CF4	D6,D7
Hollingsworth	C1,D2	C5,D1,D3
Johnstone	D3,D4	C1,C5,D1, D2
Jones	D6	D7
Juday	C7,D9	
Kasischke	C5,D1	
Kielland	C4,D11	D2,D10,SE1,SE2,SE5
Kofinas	SE1-5	
Leigh	Community Outreach	
Lloyd	C2,C7	C1
Mack	C1,D3,D4	C5,D1
McGuire	CF1,CF2,CF4	C6,D5,D8
Mulder	D2	
Romanovsky	C6,D5	
Ruess	C7,D9,D10	C1,D2,D11,SE5
Rupp	CF1,CF2	C5,D1,SE1-3
Schuur	D7	C6,D4,D6
Sparrow	SYLTER	
Taylor	D2	D10
Turetsky	D8	CF4
Valentine		C3
Verbyla	C2	
Wagner	C7,D11	D9
Yarie	C3	C1

Table 5. Planning team responsibilities for research tasks: C = Direct Effects of Climate; D = Disturbance-Climate Interactions; CF = Climate Feedbacks; SE = Social-Ecological Dynamics.

Research Area	Climate Effects	Affiliate scientist	LTER collaboration
Climate transect		Berg	McGuire
Fire behavior		Sandberg	Kasischke, Rupp
Permafrost dynamics		Fukuda	Schuur, Romanovsky
Snowshoe hare population dynamics		DiFolco, Forbey	Kielland
Stand-age reconstructions		Mann	Lloyd, Rupp
Tree ring studies		Fastie, Barber	Lloyd, Juday
Disturbance Climate Interactions			
Herbivory		Person	Kielland, Ruess
Microbial ecology		McFarland, Waldrop	Kielland, Mack, Taylor
Plant pathogens		Roy, Stanosz, Worrall	Mulder, Ruess
Plant Insects		Kruse, Werner	Wagner, Juday, Ruess
Plant species effects		Bret-Harte, Chapin	Mack, Hollingsworth
Climate Feedbacks			
Remote sensing of forest function		Goetz	Mack, Kasischke, Lloyd
Remote sensing of energy balance		Randerson	Mack
Social-Ecological Dynamics			
Food sharing networks		Gerlach	Kofinas, Kielland
Social-ecological resilience modeling		Martin, Vlacic, Gerlach, Chapin	Kofinas, Rupp, McGuire, Crone, Kielland,
Village ecosystem services		Chapin, BurnSilver	Kofinas, Crone, Rupp
Outreach and Agency Interactions			
Alaska Dept. of Fish & Game		Kellie, Brainerd	Kielland
Alaska Fire Service		Miller	Rupp, Kasischke
Arts/Humanities		Swanson	Leigh
K-12 Education		Kopplin, Stephens	Sparrow
National Park Service		DiFolco	Kielland
Rural Community Partnerships		Gerlach, BurnSilver, Chapin	Kofinas
State Division of Forestry		Maisch	Juday
US Fish & Wildlife Service		Bertram	Kielland, Ruess, Hanley
US Geological Survey		McCree, Waldrop	Harden, McGuire
USFS State and Private Forestry		Kruse, Winton	Wagner, Ruess

Table 6. BNZ LTER affiliate scientists and their principal research areas and primary contacts with LTER PIs. BNZ affiliate scientists are encouraged to participate fully in LTER activities (attend symposia, participate in monthly meetings, use and contribute to LTER database) and to receive logistic support to the extent possible, but they do not receive LTER funds to support their research.

Florida Coastal Everglades (FCE)

3. Site Management

At FCE II, our site management approach and style will continue to focus on leadership, continuity, diversity, and inclusion of junior faculty. D.Children will continue as the Lead PI into FCE II, with a plan for a leadership transition during this next phase of funding. We anticipate that this transition will be under way at the time of our next Mid-Term Review (expected in Spring 2009), so that Children and the newly chosen Lead PI can function as co-leads during this activity. Additional cover page PI leadership will be provided to the FCE II Program by E. Gaiser, M.Heithaus, R.Jaffé, and R.Price. Shortly after the FCE II 3 Year Review, we will complete this leadership transition—in plenty of time to prepare for the FCE III renewal process. We have not yet decided who the next Lead PI will be, and the process for this choice is clearly documented in our Program Administrative Guidelines (<http://fcelter.fiu.edu/admin.doc>). We do expect, however, that the new FCE Lead PI will be an FCE II cover page PI.

An important goal of FCE II program management is to balance the continuity of experience that is critical to any long-term program with the active involvement of “rising star” junior faculty in the leadership and management of the program. We will accomplish this goal in two ways. First, we have expanded our subcontracted institutions to include S.Davis (TAMU), a “rising star” who will work closely with R.Twilley (LSU) on mangrove research, and M.Rains, a “rising star” at USF who will work with our new Hydrology Working Group. We have also expanded our FCE Working Group structure to include five Working Groups and three Cross-Cutting Themes (Fig.3-1). The FCE II Working Groups each have co-leads—a cover page PI from our original FCE I proposal and a “rising star” junior faculty. The exception to this is our new Hydrology Working Group. These co-leads are:

1. Hydrology: René Price, FIU and Vic Engel, ENP
2. Primary Production: Evelyn Gaiser, FIU and Jim Fourqurean, FIU
3. Consumer Dynamics: Mike Heithaus, FIU and Joel Trexler, FIU
4. Biogeochemical Cycling: Anne Hartley, FIU and Joe Boyer, FIU
5. Organic Matter Dynamics: Rudolf Jaffé, FIU and Randy Chambers, W&M.

The FCE II Cross-Cutting themes will each have one lead, again with representation from experience and continuity (F.Sklar, who was an FCE I Internal Executive Committee member) and “rising star” junior faculty:

1. Modelling and Synthesis: Fred Sklar, SFWMD
2. Climate and Disturbance: Bill Anderson, FIU
3. Human Dimensions: Laura Ogden, FIU.

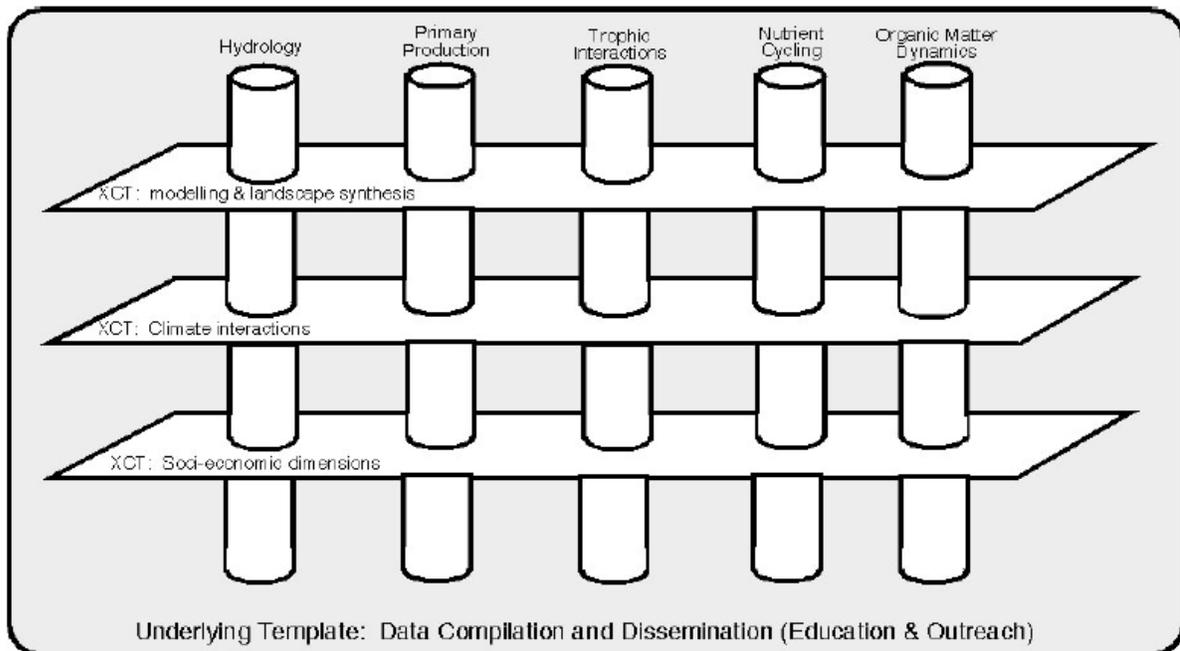


Fig 3-1: Schematic of the FCE II scientific program organization, showing the 5 Working Groups as “pillars” and the 3 Cross-Cutting Themes as “platforms” that link the pillars. The entire structure rests on an underlying template that includes information management & dissemination, and education & outreach.

We will be expanding the Internal Executive Committee to include one lead from each Working Group (rotating positions), the leads of the Cross-Cutting Themes, the Education & Outreach Coordinator, a student representative, and two outside advisors (K.McGlathery, VCR and C.Hopkinson, PIE). The Working Group leads, Cross-Cutting Theme leads, and Ed & Outreach coordinator will be voting positions (9 total votes). The FCE II IEC will continue to function under the guidelines provided in our Project Administrative Guidelines, and we have expanded our FCE I organizational structure to include the 5 new Working Groups and 3 Cross-Cutting Themes plus to elevate the overall importance of the Ed & Outreach Coordinator and the Affiliated Student Group (Fig. 3-2).

Day to day administrative activities will continue to be overseen by our Project Manager (M. Rugge), who works closely with our Information Manager (L. Powell) on the website and database mechanics. Rugge will continue to be responsible for central office accounting and procurement, including maintenance of all FCE office hardware and software and all non-field related travel. Powell will continue to manage the FCE datasets and information dissemination activities (see Section 4). Our Ed & Outreach program will continue to be run by our part-time coordinator (S. Dailey), who recently took a job teaching high school with the Miami-Dade Public School system. Dailey has continued her part-time coordination of this important program, and her “inside” position at MDPS has already begun to open new doors and present new opportunities for integrating FCE research findings into local secondary education (see Section 5)

FCE II Program Administration and Management Flow Chart

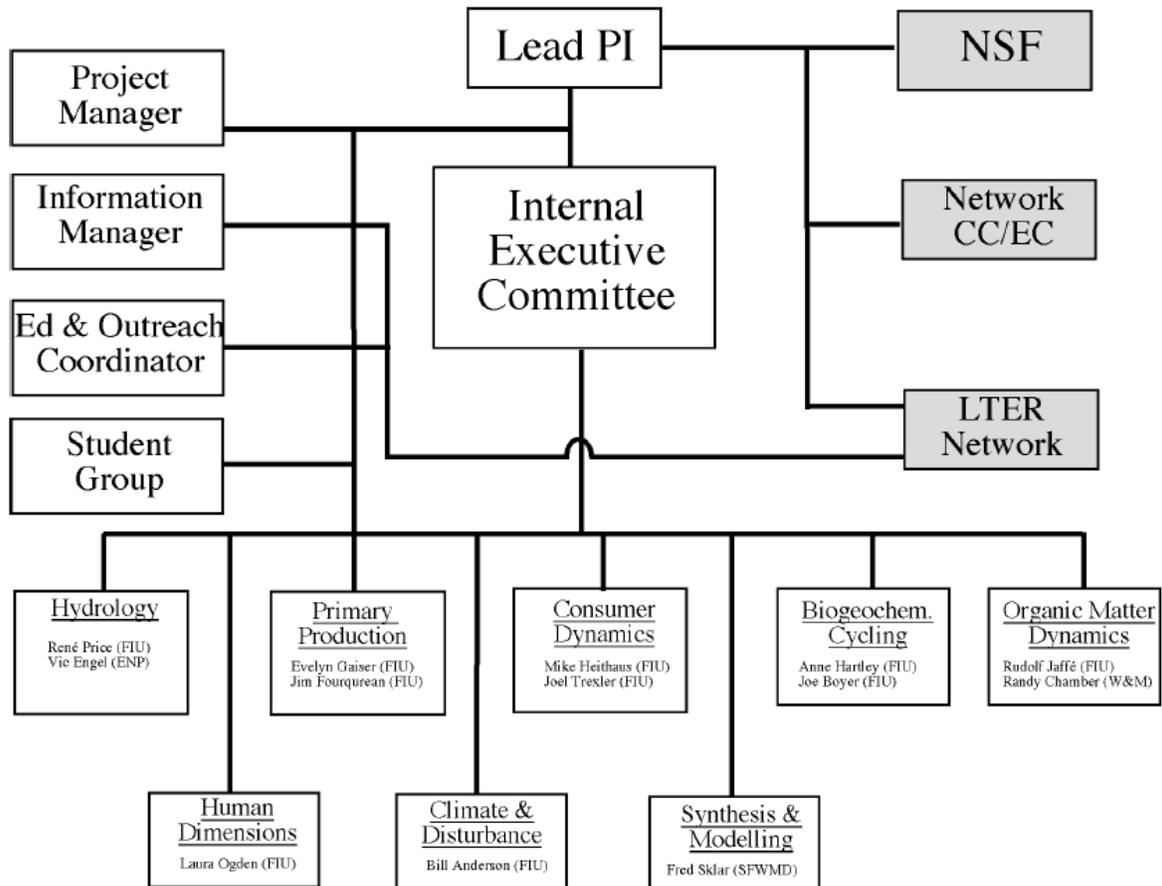


Fig 3-2: Organizational chart for the FCE II Program Administration. Lines represent communications and connections for key decisions.

Hubbard Brook Experimental Forest (HBR)

3.0 – SITE MANAGEMENT

Site Management and Facilities Primary and ultimate responsibility and authority for administering the Hubbard Brook Experimental Forest (HBR) is the Chief of the U.S. Forest Service (FS) who in turn delegates authority to the Director of the Northern Research Station (NRS), the Project Leader of NRS-07, and the Team Leader for the Hubbard Brook Experimental Forest. The FS has agreed to share the management of the overall Hubbard Brook Ecosystem Study (HBES) and the HBR with cooperating research and education institutions, recognizing the need for all parties to commit funds, personnel, and equipment to attain common long-term objectives in research, education and outreach. Because of the remote location, general supervision of the HBR is under the FS Team Leader (currently Lindsey Rustad), as delegated by the Director of the NRS. Day-to-day operations of the HBR are supervised by the resident Research Forester-Manager of the NFES (currently Ian Halm).

The FS operates a year-round field laboratory and office building at HBR. The Robert S. Pierce Ecosystem Laboratory provides 835 m² of space, including six offices, four laboratories, one conference room, six dormitory rooms, a kitchen, baths and showers. A sample archive building was constructed in 1990 to house and archive samples of soil, water, plant tissue, and other materials (see section 4.0 Information Management). In addition, there are 280 m² of maintenance, storage, garage and shop facilities. In 1983, Yale and Cornell University's purchased Pleasant View Farm (PVF), the 200-yr-old dormitory and laboratory complex, which had been rented for 18 years for use by graduate students and senior researchers, working at the HBR. In 1993, the Hubbard Brook Research Foundation (HBRF), a non-profit 501(c) (3) charitable organization was established to facilitate the housing, project logistics, education and outreach of the HBES (also see section 5.0 Outreach and Education). The HBRF assumed control of PVF and oversees the operation and maintenance of the dormitory and laboratory complex. PVF includes housing for 14 and kitchen facilities. In 2004 The HBRF purchased the Mirror Lake Hamlet, which is located adjacent to the HBR on Mirror Lake. The Hamlet provides 977 m² of high quality housing, cooking and workspace (computing, internet, meeting) facilities for an additional 50 PIs, students and visitors. The maintenance of the Hamlet is provided by a caretaker. Currently, we primarily house undergraduate students participating the HBR REU program (see section 5.0 Outreach and Education) at PVF, and PIs, visiting scientists, post-doctoral associates, graduate students, other undergraduate students and technicians are housed at the Hamlet.

Site Governance At the center of the governance structure of the HBES is the "Committee of Scientists (COS)," which consists of PIs conducting research, education or outreach in the HBR (Fig. 3.1; Groffman et al. 2004). The membership of the COS is reviewed at three-year intervals. There are currently 48 members of the HBES COS. The Scientific Coordinating Committee (SCC) provides leadership for the COS, overseeing a series of committees, providing vision and scientific leadership to the research program, fostering integration and synthesis across diverse projects, encouraging new scientists to work at the site and as part of the HBES, enhancing diversity among the HBR community, and promoting interactions and communication among HBES scientists. The "visioning" function of the SCC is considered to be particularly important as governance activities for large projects can become mired in detail.

The SCC has 10 members, five of which are elected by the COS (currently Groffman, chair, Bailey, Rustad, Rodenhouse and Campbell). Other members include one of the two HBR LTER PIs (rotating every 2 years, currently Fahey); a senior scientist (chosen from amongst a group of the five investigators with the longest experience in the HBES, currently Likens); a scientist not associated with the HBES (chosen and invited by the SCC members as an external reviewer, currently Scott Collins from the University of New Mexico); a representative from the HBRF Board of Trustees (a non-scientist, currently vacant); the USFS Project Leader for the HBR (*ex-officio*, currently Scott Bailey); and the Executive Director of the HBRF (*ex-officio*, currently David Sleeper). Note, Collins was added as our external scientist after he served on our last mid-term site review, so that we could benefit from his insights and constructive suggestions on an ongoing basis.

The Research Approval Committee (RAC) is advisory to the USFS Team Leader, who bears ultimate responsibility for research activities at the HBR (also see section 4.0 Information Management). This committee evaluates and approves proposed projects, facilitates coordination and prevents conflicts among different research projects at the site. Anyone wishing to conduct research at HBR must submit a brief proposal to the RAC (proposals are accepted three times per year). The Information Oversight Committee (IOC) is responsible for the content of the HBR web site (www.hubbardbrook.org), data management and maintenance of the HBES data, sample and document archives (also see section 4.0 Information Management). The Program and Meetings Committee (PMC) organizes a series of COS meetings (four per year) as well as the annual HBES Cooperators' Meeting. The Education and Outreach Committee (EOC) facilitates links among HBRF, HBR-LTER and HBES research and learning groups ranging from K – 12 to undergraduates to local residents to management and policy communities (see section 5.0 Outreach and Education).

The quarterly COS meetings are a key venue for project management; with time allocated for logistical issues (25%) and discussion of overarching scientific topics (75%). All investigators (i.e., PIs, post doctoral associates, students) working at HBR are required to make presentations at the annual Cooperators' Meeting in early July which is attended each year by approximately 150 people and includes a keynote speaker sponsored by the HBRF (in 2009 the speaker was Jim Collins of NSF), group dinner, barn dance and midnight swim that facilitate project morale and cohesion.

To date, our governance structure has been effective and we anticipate that it will help maintain the vitality of the HBR-LTER and HBES for decades to come. We expect that this approach to governance will help maintain the integrity of the long-term data and experiments, attract new people to the project, facilitate transitions in the study, encourage and enhance diversity among scientists working at the site, help us to develop new ideas and experiments, and increase participation in project leadership. This structure has enabled us to focus more on our vision for the future of the HBR-LTER and HBES. The SCC and PMC establish an agenda to foster regular discussion of issues such as “new experiments,” “synthesis,” “gaps in coverage,” “strategies to attract new scientists and enhance diversity” and “improvements in education and outreach.”

Our governance structure, conceptual model (Groffman et al. 2004) and the LTER framework for Integrative Science for Society and Environment (LTER 2007) have been useful in the preparation of this renewal proposal, allowing researchers to articulate how their ideas fit

into the HBR-LTER, the overall HBES, LTER Network initiatives, and organizational framework of the project in a public and transparent process. This process has helped the PIs make decisions about how to allocate LTER funds for in a scientifically sound, semi-democratic way that allows for the development and evolution of the HBR-LTER.

The governance structure has also facilitated our ability to increase and maintain the participation of new scientists and under-represented groups in the project, which has been identified as a priority in previous reviews of the HBR-LTER. In recent years we have been encouraged by a number of new scientists who are working in the HBES, including Pamela Templer (microbial and plant processes, Boston Univ.), Andrew Richardson (land-atmosphere dynamics, data fusion, Harvard Univ.), Lynne Christensen (moose, biogeochemistry, Vassar College), Kevin McGuire (hydrology, Virginia Tech), Mark Green (hydrology, Plymouth State Univ.), Christine Goodale (biogeochemistry, Cornell), Winsor Lowe (salamanders, Univ. of Montana), Beverly Wemple (forestry, University of Vermont), Michele Pruyn (plant ecology, Plymouth State) and Laura Schneider (geography, Rutgers). This influx of talented new scientist is expanding the scope of research and invigorating the HBR research community. Though the HBRF, the Hubbard Brook Consortium and the REU, we work aggressively to encourage and facilitate people from underrepresented groups working at the HBR.

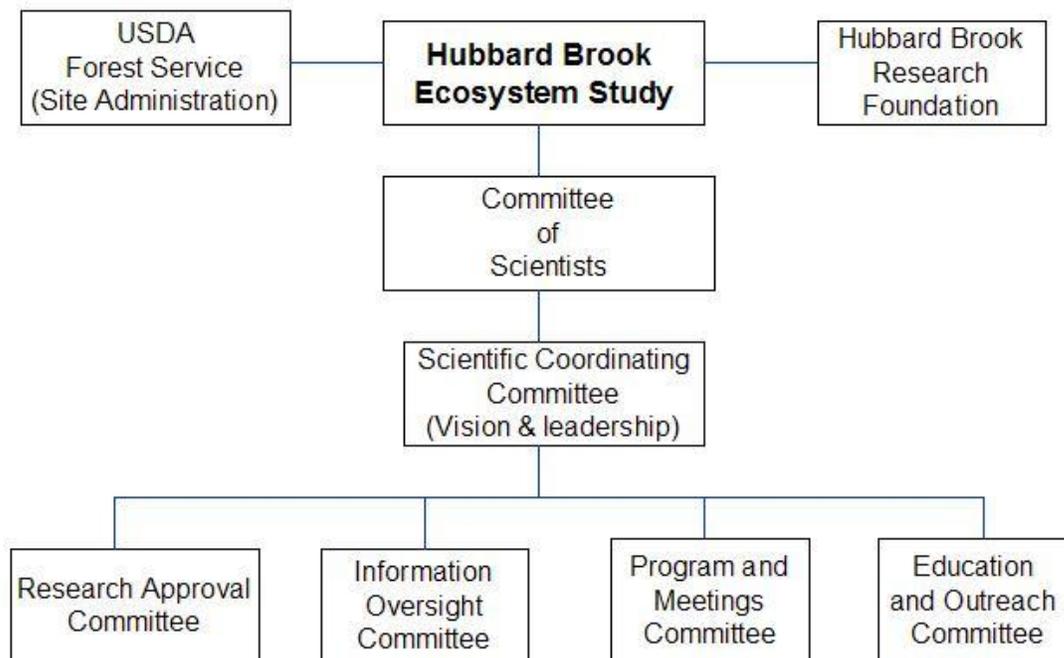


Figure 3-1. Governance structure of the Hubbard Brook Ecosystem Study.

Kellogg Biological Station (KBS)

3.0 Project Management

Overall Leadership. The KBS LTER Project is led by an Executive Committee (EC) chaired by lead PI Phil Robertson. Also serving on the Executive Committee are project co-PIs Kay Gross, Steve Hamilton, Doug Landis, Tom Schmidt, Sieg Snapp, and Scott Swinton, as well as our Education and Outreach Coordinator Julie Doll and our to-be-named Research Coordinator (see below). The EC meets bimonthly or more often as needed. Members of this committee have specific responsibilities: Robertson as lead PI and chair of the EC provides overall project leadership; he is the principal project contact for NSF, the LTER Network, and the University, and has overall responsibility for senior project staff.

Each co-PI actively participates in all decisions regarding project coordination, management, and scientific direction; supports site promotion including hosting visitors, providing presentations, and promoting the use of the site by students and colleagues; leads efforts to secure outside funding for workgroup research; participates in Network-level activities; and prepares or coordinates workgroup data for incorporation into the site database.

Additionally, each co-PI leads specific research areas:

- Agronomic Dynamics (Snapp)
- Plant Dynamics (Gross)
- Microbial Dynamics (Schmidt)
- Insect Dynamics (Landis)
- Human Dynamics (Swinton)
- Watershed (Hamilton) and Field-scale (Robertson) Biogeochemistry

Project Coordinators. Two academic specialists provide high-level project support and coordination. These are new positions, created with university support in 2009, intended to address leadership transition issues identified in our 2007 site review. A follow-on internal review in 2008 identified alternatives for addressing these issues, among them the creation of positions to provide administrative support and leadership in the areas of outreach and overall research coordination. These positions, coupled with the creation of oversight committees, have allowed Robertson to continue as lead-PI. Both are academic specialist (non-tenured faculty) positions funded with a university cost-share contribution (see Section 7).

One position is a **research coordinator position**, expected to be filled in spring 2010. Responsibilities of this position include promoting research potentials to prospective investigators, including students; coordinating KBS participation in network partnerships and responses to network initiatives; organizing all-scientist meetings; helping to organize responses to emerging research opportunities; preparing reports to agency and other partners; coordinating annual reviews of project and information management activities; and acting as first point of contact for prospective investigators

The **outreach/education position** is held by Julie Doll, who is responsible for the development and delivery of educational and outreach programs and materials. This includes workshops for stakeholders, including agribusiness professionals, farmers, extension educators, staff of state and federal regulatory agencies and NGOs, and other publics as described in Section 5. Doll works closely with other faculty and staff involved in education/outreach at KBS, particularly MSU Extension personnel. She is also responsible for coordinating programs for

graduate students and undergraduate interns working on site, and works closely with the KBS GK-12 and Math and Science Partnership coordinators (Section 5).

Committees. Three project-wide committees currently advise the Executive Committee in specific areas. Members of the **Research Advisory Committee**, co-chaired by Hamilton and Swinton, include both KBS co-Investigators and researchers not otherwise associated with LTER, and provide advice on research direction and new initiatives. This committee, first formed in 2008, meets twice per year. The **Education and Outreach Committee**, co-chaired by Gross and Schmidt, is charged to provide advice on K-20 and public outreach efforts, and also meets twice per year. C.W. (Andy) Anderson, our network educational representative, also helps to lead this committee. A third, **Agroecology Committee**, is co-chaired by Snapp and Landis and provides agronomic advice, including specific management recommendations for our main cropping system experiment. Included on this committee, which meets twice per year, are farmers, county extension educators, and university field crop specialists. A new **Information Management Committee** will be formed in 2010 to provide advice to the EC and Information Manager on data recruitment issues as described in Section 4.

Technical Staff. Core project staff include a Project Manager (Stacey VanderWulp) responsible for most core sampling activities including analyses, and who reports to Robertson. VanderWulp supervises the laboratory staff that includes a research technician (Cathy McMinn) and 2-3 seasonal employees. Our full-time Information Manager (Sven Bohm) also reports to Robertson and is responsible for data management. A second database programming position is being added in 2010 (see Sections 4 and 7.4).

Co-investigators. Co-investigators (Section 8) are organized into the six research topic areas noted in Section 2 and above. The purpose of the topic groups is to stimulate discussion of research results and plans among members of the groups to better identify emerging topics and trends that bear further investigation. A number of the projects underway on site with non-LTER funding emerged from these types of discussions. Topic groups meet irregularly at the discretion of the topic group leader, but at least annually at our all-scientist retreat. This is usually an overnight meeting at KBS that involves research presentations, posters, and discussion groups. Our 2009 meeting (<http://lter.kbs.msu.edu/meetings/16>) had 88 participants.

Site Promotion. We promote use of the site by actively encouraging colleagues and students to consider research at KBS, and through our web site (<http://lter.kbs.msu.edu/>) at which we post site description and access information. During the period 2004–2009 we hosted 79 non-LTER funded research projects on site, ranging from \$5k doctoral dissertation improvement awards to several >\$1M/y collaborations. Nineteen of these projects are led by non-MSU researchers. Funding agencies include USDA (NRI/AFRI, Sustainable Agriculture, NCR Regional Projects, and Special Grants programs), NSF (Ecology, Ecosystems, DDIG, RTG, EHR, ICEB, Biocomplexity programs), DOE (Global Change), Canada's NSERC/CRSNG, the Michigan Agricultural Experiment Station, and private foundations such as the A.W. Mellon Foundation and the Electric Power Research Institute. In 2008 the Univ. of Wisconsin and MSU formed the DOE Great Lakes Bioenergy Research Center (GLBRC); the sustainability portion of the Center (~\$4M/y) is based at KBS with field sites at KBS and Arlington, WI (see Section 2).

Site Access. As do other LTER sites, we maintain the KBS site as a national research facility available to all scientists with a legitimate research interest. Access to the site is limited in order to protect the integrity of existing experiments, but we welcome additional experiments and sampling activities that 1) are relevant to overall project goals of understanding ecological interactions in row-crop ecosystems, 2) are best answered in a stable long-term experimental setting such as that provided by the LTER site, and 3) meet the project's data-access criteria. We require of researchers working on site or with samples from the site written assurance that they will follow procedures expected of all researchers on site (explained at http://lter.kbs.msu.edu/about/site_access/about.php). We require of all researchers submission of a formal site use request form (via a form at the url above) that is reviewed and approved by the PI and EC.

Leadership Change. Since the beginning of the last renewal period we have had a normal level of senior and co-investigator turnover. Long-time co-PI Stuart Gage retired in 2008 and with this proposal rotates out of the co-PI group. In 2005 the university created a senior faculty position in soil and cropping systems ecology to fill the absence created by Dick Harwood's earlier retirement, and Snapp was recruited to that position and is now a co-PI. Robertson, Gross, Hamilton, Landis, Schmidt, and Swinton continue as co-PIs from as early as 1988. Three additional faculty positions with LTER associations have been created at MSU since 2004, partly in response to NSF reviews, and will add considerable strength to the project. Stuart Grandy was hired into a soil biology position created after Eldor Paul's retirement, and two Sociology positions were created in 2009 to strengthen our ability to address socioecological questions: Diana Stuart will join MSU in 2010, and an Assoc. Professor now being searched will also be associated with the project. These four additions to the MSU faculty since 2004 are an additional signal of MSU commitment to project success (see also Section 7.4 University Cost-sharing). We are hopeful that Gage's large-scale modeling / regionalization expertise will be likewise replaced in the coming years.

McMurdo Dry Valleys (MCM)

SECTION 3

SITE MANAGEMENT

McKnight assumed leadership of MCM3 in September 2009 and will continue as lead PI for MCM4; she will undergo annual reviews by the MCM PIs. As shown in the MCM Internal Links diagram (**Fig. 23**), the Executive Committee (EC) provides guidance to help manage all phases of the project. This system has worked well since the project began and will be continued. McKnight has appointed 4 new EC members for MCM4 including 2 from the new PIs named below and will hold monthly conference calls with them. The management office of MCM is at the Institute of Arctic and Alpine Research (INSTAAR) at CU. Currently, Jeff Walters provides administrative assistance for the grant and coordination of interactions among the PIs. In MCM4, this role will be filled by a fulltime staff person. The CU staff person will coordinate field logistics and work with Lyons at OSU to prepare the field planning documents that are due before each field season. OSU provides a fieldwork coordinator during the 4-month field season. This preparation includes the allocation of field personnel, field equipment, helicopter hours, and chemical analysis of samples at the Crary Laboratory in McMurdo Station.

The PIs meet twice a year (**Fig. 23**). In the interim, communication among PIs occurs through email and bi-weekly conference calls. The first meeting is in February/March to review the activities of the past field season and to plan for the next one. The summer meeting has a science focus and includes students, technicians, post docs, and collaborators. The meeting site has rotated among the home institutions of all the PIs. In July 2008, 22 people attended the science meeting at UIC. In addition, a small workshop on lake modeling was convened subsequently. A science meeting attended by current PIs as well as the new PIs for MCM4 was held at Dartmouth (July 2009) and focused on the role of connectivity in MDV landscapes. MCM scientists and students had an official meeting during the LTER All Scientists Meeting in September 2009.

There are major changes to our organization in MCM4. We have gone from 8 to 12 PIs with the 4 new PIs bringing diverse expertise to the project. Gooseff has already replaced Hunt as the PI for ecosystem modeling. Adams is an expert in soil invertebrate ecology and phylogeography. Barrett is a biogeochemist with interests in terrestrial-aquatic linkages. Howkins is an environmental historian with extensive polar history connections in England and throughout South America. Takacs-Vesbach is a molecular ecologist who focuses on microbial biodiversity and function in extreme environments; she will replace Lyons as the PI responsible for information management (IM) for MCM4. As a PI with expertise in this area and proximity to the network office, Takacs-Vesbach has excellent understanding of the potential uses of the genomic data within a relational framework and she will serve as a liaison between MCM and network IM activities. New developments for IM will also be facilitated by the Data Management Committee comprised of two PIs and technical staff.

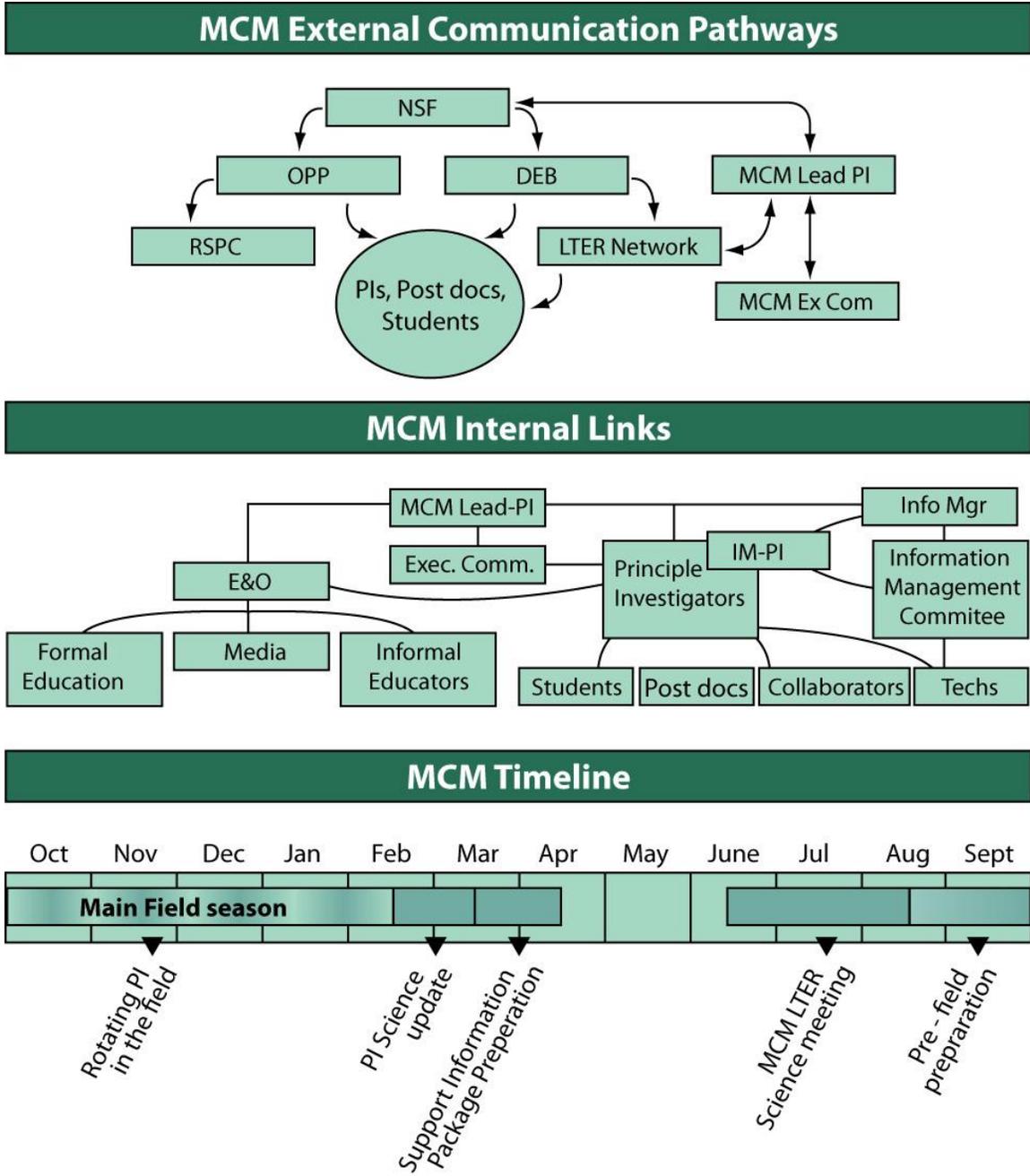


Figure 23: MCM-site management diagram

Niwot Ridge-Green Lakes Valley (NWT)

Section 3. Management of the Niwot Ridge-Green Lakes Valley (NWT) LTER

History: Part of the first cohort of LTER sites, the NWT LTER began in 1980 as a University of Colorado (CU) Institute of Arctic and Alpine Research (INSTAAR) multi-investigator ecosystem program. The LTER consisted of a consortium of PIs, each managing his/her own programs. This model was deemed unsuccessful, and an improvement and reorganization of the program commenced in 1990 under the leadership of Dr. Nel Caine, who is now retired from CU-Boulder but remains actively involved with NWT LTER. Faculty outside of INSTAAR were recruited to the program, including Dr. Tim Seastedt, the administrative PI on the 1992 and 1998 renewal proposals. An Information Manager for the NWT LTER was hired, and additional core staff (lab coordinator and field technician) were added in 1992.

Current: Since 1998, the NWT LTER program has been directed by the PI, who is responsible for developing the annual budget and coordinating the infrastructure and science programs. The signatory Co-PIs support the PI on administrative activities both locally and for the LTER network. All Co-PIs are involved in science writing, the overall science program, and program development (Figure 3.1). Science coordination is accomplished via e-mail, LTER meetings at INSTAAR, faculty and graduate student seminars, and an annual full-day workshop held in late August at the Mountain Research Station (MRS). The graduate students involved in NWT studies, a group larger than that comprised of PIs, are an important intellectual and social linkage for the group.

NWT LTER is fortunate in that the majority of our senior scientists are at CU-Boulder; the only subcontract is to Professor Katie Suding at UC-Berkeley, a former post-doc at NWT LTER. We emphasize that the science component of NWT LTER is clearly a group effort. The LTER program focuses on those projects and studies that can be accomplished using (1) the core staff of LTER field, laboratory, and information management personnel; and (2) a partially-supported investigator and graduate research program. Intensive science efforts require extramural support beyond that provided by the LTER; therefore, our group uses LTER funding to address a framework of core questions, but also uses these data to leverage additional support to enhance particular research efforts. From 2004 to 2010, LTER senior personnel have generated extramural funding of about \$20,000,000 on LTER-related projects, a return of almost 5 dollars for every LTER dollar. We have also leveraged NWT LTER participation in two large new environmental observatories: (1) the Boulder Creek Critical Zones Observatory for which the NWT LTER is one of three test basins; and (2) NEON, where NWT LTER is the core site for the Southern Rocky Mountains-Colorado Plateau (domain 13).

The Mountain Research Station remains a major component of the NWT LTER program. Directed by Bowman (Co-I on this proposal), the MRS provides logistical support for the LTER program. The MRS coordinates (1) our involvement in the Niwot Ridge Man and Biosphere site, the special-use permit by which we operate on the Forest Service lands used for most terrestrial research; and (2) research in the Green Lakes Valley, which is owned by the City of Boulder and requires very restrictive special-use permits. The MRS houses the offices for the field technician and climatologist, maintains the Tundra Laboratory at 11,500', and organizes travel from the field station to the tundra sites. Completion of the family-friendly Moores-Collins Lodge in 2005 provides year-round use of the MRS for families, courses, retreats, and conferences.

The lodge is self-sufficient, with the capacity to house 32 people in 8 sleeping rooms, and contains a kitchen, bathrooms/showers, a meeting/eating room, and lounges. In addition to training several undergraduates annually as part of the LTER-REU supplement, LTER researchers comprise much of the faculty involved in a site-based REU summer research program at the MRS (Bowman PI). These students are housed at the MRS and work on their own projects alongside graduate students and faculty. This program has been remarkably productive, with many of these students lead-authoring or co-authoring research efforts published in journals worldwide.

Changes: Experience has shown that the 1998 management model is appropriate for our site, with the following changes. First, continuity of leadership has been ensured; Williams was the PI for the 2004 renewal and has the same role for this proposal. Williams will transition off as PI for the mid-term site visit so that the new PI will have three years of experience with the LTER network before writing the renewal. We have formed an internal executive committee that is composed of the Co-Is on this renewal to provide feedback to and oversight of the lead PI. The executive committee met weekly for two months in fall 2009 to craft the outline and overarching objectives of this proposal. For this round of funding, we will form an external steering committee to facilitate synthesis and integration of NWT LTER with other regional programs, including the PI of the Boulder Creek CZO, USGS lead for the Loch Vale WEBB program, the USFS lead for their GLEES program, and the project scientist for domain 13 of NEON.

Postdoc mentoring: Post-docs on this proposal will receive individual and group mentoring. Williams as PI will have ultimate responsibility for the mentoring program. NWT LTER scientists whose discipline the post-doc most closely matches will have day-to-day mentoring responsibilities, e.g., Schmidt will mentor Mladenov. Our mentoring plan consists of three parts: a) self-assessment by the postdoctoral scholar; b) scheduling regular meetings; c) conducting a final evaluation.

Diversity: We have several strategies for enhancing diversity at the NWT LTER. One is to lead by example. Mark Williams, the PI on this renewal, is a Hispanic and a first-generation college graduate. Also, we participate in the Summer Multicultural Access to Research Training (SMART) program, allowing under-represented undergraduates to conduct summer research in science and engineering. Several members of the SMART program are now graduate students working at NWT LTER and mentoring new undergraduates. Finally, we actively recruited women to be senior scientists and postdocs on this proposal.

Plum Island Ecosystem (PIE)

SECTION 3. SITE MANAGEMENT

GOVERNANCE AND COORDINATION

Overall direction and management are provided by lead PI, Anne Giblin, and an Executive Committee. The Executive Committee consists of Giblin, the leaders of each programmatic area, and a representative of the social sciences (currently Gil Pontius). The current program coordinators are:

<u>Program area</u>	<u>Coordinator</u>
1) Watersheds	Wil Wollheim
2) Marshes	Jim Morris
3) Estuary	Chuck Hopkinson
4) Higher Trophic Levels	Linda Deegan
5) Synthesis and Modeling	Joseph Vallino

The Executive Committee is consulted on all financial matters, approves budgets and supplement requests, collects information for annual and final reports from other members of their program area, and facilitates transitions in leadership. Coordinators keep all members of the LTER informed about activities and findings in their program area, including those of other grants closely related to the LTER. Each program area holds regular meetings that bring together PIs, students, post-docs and research assistants. Often these meetings involve several groups meeting together, either formally, or informally at the field station.

During the last grant we had several changes in leadership. Anne Giblin took over for Chuck Hopkinson as lead PI. Hopkinson is still very actively involved and has taken over the direction of our Estuary program from Bruce Peterson. Wil Wollheim replaced Charles Vorosmarty as watershed coordinator when Vorosmarty moved to City College of New York. As was discussed in the previous section, our former program area of benthos has been eliminated in this renewal and the research and long-term monitoring were merged into Estuary and Higher Trophic Levels.

Elizabeth Duff, of Massachusetts Audubon serves as our education coordinator, and is included in all discussions that involve education and outreach. Robert Buchsbaum, also from Massachusetts Audubon, coordinates with government agencies and NGOs in the PIE-LTER area as part of his position. Buchsbaum also actively participates in many aspects of higher trophic level and marsh research at PIE so he and Duff have a thorough understanding of PIE science and education. This allows them to very effectively assure that PIE outreach activities are targeted to the proper audiences.

Major research directions and strategic planning, are discussed with all of the PIs and senior personnel on the project and decisions are reached by consensus. As an example, all of the PIs and senior personnel, as well as key research assistants, participated in monthly video-conference calls in the year leading up to this renewal to develop our new questions and research approaches. This approach proved very successful, and we will continue to hold several meetings each year this way to supplement our annual meeting.

Each spring we hold a meeting of all scientists, post-docs, students and research assistants associated with the project. All personnel working on the PIE-LTER and related

projects are invited to attend and make presentations. At our annual meeting we summarize the results of individual program areas, synthesize across disciplines, and plan the research program for the following year. Graduate students present thesis ideas and participate in the planning for the upcoming field season. We also encourage representatives of the other governmental agencies and NGOs working in the area to attend and give presentations.

ENCOURAGING NON-LTER SCIENTIST PARTICIPATION AND COORDINATION

We encourage non-LTER scientists and students to work at PIE and whenever possible assist them with access to the site, housing and computer facilities while at the site, and data and maps to help plan their research. The major way we have been able to broaden long-term participation in the project is by writing grants with non-LTER investigators. We coordinate logistics such as housing and boats through our web site. Scientific coordination is achieved through our annual meeting, and by interactions with other PIE investigators. Our program coordinators usually serve as the key points of contact for long-term projects. Investigators coming for short periods of time usually contact Giblin who puts them in contact with the PI or RA most able to assist them. Buchsbaum has played a key role in helping scientists from other LTER sites find useful sites for comparative studies.

INCREASING DIVERSITY

At the K-12 level we have increased the number of minority students participating in the program by adding the Collins Middle School in Salem to our program. Our undergraduate activities are advertised widely. We now get many more women applicants than men but still have trouble recruiting minority students. We have targeted increased coordination with Brown and the MBL-SES program, which have active minority recruiting programs, to help us increase minority participation. At the graduate, and post-graduate level we advertise positions widely. The PIs at each of our institutions use the list serves set up by scientific societies and their own human resources departments to assure a wide distribution of position announcements.

PI ADDITIONS

We are adding Colin Polsky (Clark University) and Christopher Neill (MBL) to the project with this renewal. Polsky has been involved in the PIE LTER for the last 5 years through his collaboration with PI Gil Pontius on Clark University's "HERO" program and through the social science supplements to the PIE LTER. Polsky broadens the expertise in social science within the LTER and will further increase undergraduate and graduate involvement. Neill brings expertise on the impact of changes in land use and land cover on forest and terrestrial plant communities and on water and material exports from the terrestrial side. He will form a link between the social science research being done at Clark and work on watershed exports and processing being done by UNH. Neill is currently director of the Brown MBL program so he will be able to help increase undergraduate and graduate participation.

FIELD FACILITIES

Our field facilities were greatly expanded in 2003 when MBL purchased the Marshview Farm in Newbury, MA. This facility has sleeping space for 13, a small laboratory, and storage space for equipment and supplies. The Marshview facility is supplemented by the Rowley Field House, which is rented from a local land trust, the Essex County Greenbelt Association. The Rowley House sleeps up to 8 in tight dorm-type accommodations. Most importantly it provides on-site dock facilities for 3 boats to give us easy and immediate access to the water. The Rowley site

also provides walking access to many of our field sites. These two facilities have been sufficient for LTER needs over the last 7 years. Most of the time we have been able to also accommodate students, PIs, and post-docs from related projects, but requests at some times of the year now exceed our capacity. We have provided housing for additional researchers (such as scientists doing short term comparative field studies from other LTERs) whenever we could but in summer space is often limited. While our space is sufficient for direct LTER needs, the overall growth of research at the site may soon be constrained by our facilities. We are looking for ways to alleviate this. During the last funding cycle we received NSF funds for a planning grant to remodel the Marshview Farmhouse and barn. We used this plan, and our experience on the needs of the current researchers, to submit a grant to upgrade the facility. If this grant is not successful we will continue to search for other funding avenues and have the support of the MBL development office to pursue private funds for this purpose. We are also instituting a small daily fee for outside projects for overnight housing to help maintain and support the facilities and docks.