CFRNET: COORDINATING BIOLOGICAL FIELD RESEARCH FOR THE BENEFIT OF CANADIANS

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EXECUTIVE SUMMARY

Global environmental change is rapidly bringing the value of biological field research to the fore. Policy makers are increasingly aware that understanding, predicting and managing environmental change can have profound impacts on human well-being and the economy. Biological field research plays a vital role in providing this understanding. The many other benefits of biological field research include contributions to innovations in medicines, development of sustainable resource harvest practices, or identification of harmful levels of pollutants.

Field stations are the primary infrastructure through which biological field research is delivered. They support place-based, multidisciplinary research over a sustained period of time, provide safe and cost-effective access to sometimes remote study sites, and facilitate the delivery of cutting-edge science that is integrated into the natural environment. Research at field stations allows for an understanding of complex interactions among ecosystem processes and across spatio-temporal scales in a way that is not possible by combining individual studies carried out in isolation. As "places to learn the art of discovery" field stations also play a vital role in education and the training of Highly Qualified People.

Canada has a number of biological field stations distributed across the landscape, and these vary widely in size and focus. Stations occur in all of Canada's terrestrial Ecozones, but the degree of representation within these Ecozones varies widely. We report the distribution across Ecozones for the 122 field stations included in our assessment. Despite the diversity of stations and their wide distribution across the country, most share a common concern about the lack of stable funding to support their long term research and monitoring activities.

Recent changes in funding practices and priorities have heightened this concern. Some field stations are in immediate need of new sources of funding in order to maintain their valuable infrastructure and ensure the continuity of their priceless long term datasets. Increased public appreciation and political support for field stations' contribution to society is necessary for sustained funding in the long term. The current level of support does not accurately reflect the value to society, both intrinsic and extrinsic, of the research and monitoring carried out at these stations.

The Canadian Field Research Network (CFRnet) is proposed as a means of increasing this awareness of value, while simultaneously increasing the level of the science carried out. Elsewhere in the world, large-scale networks coordinating research activities among field stations are generating significant new funding because they are tackling the pressing and large-scale questions of environmental change and sustainability. Despite some previous efforts to achieve large-scale coordination, Canada currently has no national network to coordinate the research and monitoring occurring at field stations. The vision of CFRnet is to unite field stations across Canada, foster collaboration and promote the benefits of stations' activities. Coordination under a common network could be beneficial in elevating the profile of Canada's biological field stations. More importantly, this coordination is necessary if Canada is to keep pace in a global economy this is increasingly influenced by environment and ecology.

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BIOLOGICAL FIELD RESEARCH IN A CHANGING WORLD

Rapid environmental change has heightened global concern about the status and trends of the world's ecosystems. Despite international commitments through the Convention on Biological Diversity to slow the rate of biodiversity loss by 2010, the declines continue (Butchart et al. 2010) with profound impacts on the stability and recovery potential of ecosystems, as well as the provision of valuable ecosystem services (e.g., Worm et al. 2006). Some aspects of global climate are changing at a rate that outpaces model projections. For example, September 2012 saw another record minimum extent of sea ice in the Arctic (NSIDC 2012), well ahead of IPCC predictions (Solomon et al. 2007). These and other radical shifts in the natural environment have fostered a sea change in public perception of the need for monitoring and understanding the natural environment.

Research into ecosystem structure and function, monitoring of species diversity and other aspects of biological field research were once viewed as the realm of esoteric scientists at worst, or at best, contributing to a general understanding of the natural world and conservation of species for their intrinsic value (e.g., Soulé 1985). Increasingly, through the recognition of the value of ecosystem services, biological research and monitoring are viewed as contributing to human health, well-being and economic prosperity (e.g., Cardinale et al. 2012). Policy makers look to ecologists for insights into how ecosystem functions have been altered, and for predictions of future changes and their consequences.

Biological field stations are the primary infrastructure through which field research is delivered and as such, play a central role in providing this ecological understanding. These stations facilitate long term research, offer a platform for collaboration among scientists with diverse interests, and support innovation in variety of ways. In addition, these stations offer an opportunity for education and outreach, engendering public appreciation for natural history and its study, and training the next generation of field biologists. This report reviews the contribution of field stations to the understanding of ecology and their value to society. With an emphasis on Canada, we examine the current status of field stations and the financial challenges that threaten their persistence. We offer a proposal for coordination among field research stations, and discuss the potential benefits of this model.

IMPACTS OF BIOLOGICAL FIELD RESEARCH

Biology is a study of complex interactions. Laboratory experiments offer scientists the ability to reduce this complexity and study form and function in a controlled environment, under a microscope both figuratively and literally. Field research searches for the bigger picture by bringing these principles into a natural setting and grappling with the full complexity of nature. Mechanistic insights from the lab yield predictions to test in the field and observations from the field yield new questions to be asked in the lab; the exchange between these complementary forms of inquiry is synergistic.

It is self-evident that biological field research contributes to an understanding of the natural world, and although difficult to measure, this basic understanding lays the foundation for subsequent innovation. Increasingly though, the value of research is gauged in terms of its direct link to innovation, influence on public policy or benefits to human well-being. Tangible examples of the benefits of biological field research are many and varied, from discoveries in molecular biology and physiology that have led to innovations medicine, to landscape-scale insights into ecological processes that have changed how we harvest resources or regulate pollution.

Despite advances in modern medicine, unique chemical compounds observed in nature remain a significant source of drugs for humans. For example, 74% of anticancer compounds are either natural products or derived from natural products (Tan et al. 2006). Unique physiological characteristics observed in nature also lead to innovation in the health sciences. Studies of auditory mechanisms of the parasitoid fly *Ormia ochracea* led to the development of a new form of directional microphone for use in the hearing aid industry (Miles et al. 2009). Cuticular waxes, such as are found on the leaves of trees or the exoskeletons of insects, are being investigated as a source of superhydrophobic surfaces to control protein absorption and cell adhesion for the biomedical industry (Webb et al. 2011). These are just a few of the myriad examples of biomedical applications of phenomena observed in the natural world. And with perhaps 86% of species on land and 91% of species in the ocean still yet to be described (Mora et al. 2011), the potential for future applications is practically limitless.

An understanding of larger-scale ecological processes also has innumerable practical applications, from management or conservation of natural resources to prediction, monitoring or regulation of human impacts on the environment. An expanding human population, ever growing demand for resources, and a rapidly changing global environment have all contributed to a current emphasis on sustainability and ecosystem-based management (e.g., Pikitch et al. 2004, Berkes et al. 2012). Many of the scientific principles underlying modern resource management were developed through field research, including the principles of sustainable forestry and fisheries management. Similarly, monitoring of ecosystem condition has led to a variety of regulations governing release of harmful pollutants or other actions that threaten the long term integrity of the natural systems that sustain both health and economy.

Ecological research has demonstrated that disturbance from agents such fire, wind and insects are fundamental regulating processes in many temperate forests, and the goal of modern forest management is to emulate these natural disturbances at a variety of spatial scales. In the pacific northwest of the United States, this shift towards ecosystem management emerged from studies of ecosystem structure and function at the H.J. Andrews Experimental Forest, Oregon (e.g., Franklin et al. 1981, 1989), where some of the first demonstrations of the principles occurred (Michener et al. 2009). Ecological research is directly integrated into forest management in Canada too, such as in Ontario where harvest prescriptions seek to maintain a variety of ecological characteristics within the Estimated Range of Natural Variation, to ensure the long term sustainability of the harvest (OMNR 2010).

Similarly, fisheries management has long been actively integrated with biological research that monitors populations in order to establish maximum sustainable yield (e.g., Shaefer 1954). More recently, inadequacies of this single-species approach have become apparent and research has offered up a new paradigm of Ecosystem Based Fisheries Management (e.g., Pikitch et al. 2004). This approach ensures sustainability across entire ecosystems, and may be the revolutionary change necessary to reverse the declines so prevalent in fisheries around the globe (Berkes 2012).

Our definition of biological field research here includes studies that monitor environmental characteristics over time. The examples of environmental monitoring leading to regulatory change in Canada are many; observations of algal blooms in the Great Lakes led to regulations limiting phosphorus inputs into aquatic systems, observations of ecological damage in the 1970s led to the formation of international agreements regulating the release of pollutants related to acid rain, and decades of observations of biodiversity loss has led to international treaties such as the Convention on Biological Diversity, federal and provincial Species at Risk legislation, and other regulatory measures.

These are but a few of the innumerable examples of the profound, direct influence of biological field research on human health, economy and public policy. For public policy in particular, environmental considerations have become increasingly important as the evidence for an anthropogenic influence on the global climate has become irrefutable (Solomon et al. 2007), the value of ecosystem services, and thus the cost of unsustainable resource use, has become better understood (Constanza et al. 1997, Anielski and Wilson 2005), and the links between biodiversity, ecosystem stability and human well-being have become apparent (Cardinale et al. 2012). The room for improvement is still dramatic however, as Canada lags well behind other OECD countries in terms of environmental performance (OECD 2004, OECD 2009); in one study, Canada ranked 24th out of 25 comparator countries owing primarily to inefficient environmental policies (Gunton and Calbick 2010).

A recent review of the status and trends of ecosystems in Canada suggested that several ecosystems or natural processes were compromised or reaching critical thresholds, including fisheries that are failing to recover and rising nutrient loading in the Great Lakes despite previously successful regulations to control nutrient inputs (Government of Canada 2010).

Research and monitoring underlie sound policy, and an improved contribution of biological research could improve Canada's environmental performance. As our impact on the natural world increases, regulations that seek to maintain our activities within the limits of sustainability will become more numerous and necessarily more restrictive. Accordingly, the science behind these regulations must bear the closest scrutiny.

Research and monitoring sometimes yield surprising insights with unanticipated significance, so it is difficult to list the characteristics that make for valuable biological field studies. However, in terms of direct application to public policy, some common characteristics are evident (reviewed in the recent Ecosystem Status and Trends report; Government of Canada 2010). Long-term monitoring with good statistical design and broad spatial coverage at the ecosystem scale (rather than political jurisdictions) offers the most useful assessments, but is currently lacking for many important ecological components (Government of Canada 2010). Research provides the context for interpreting monitoring results, but often occurs over a shorter time scale; the insights provided by ecological research are more valuable when they are integrated with longer-term monitoring (Govenrment of Canada 2010). Multidisciplinary studies yield the most relevant insights for policy development, and coordination of data collection across spatial- and temporal scales ensure that results can synthesised across scales, at the level necessary for decision making. This review also identified some common themes in information gaps to be addressed by ecosystem research and monitoring:

1. ***Poor understanding of thresholds, baselines, and natural ranges of variability in ecosystems***
2. ***Limited information on changes in food web structures***
3. ***Little research and monitoring that addresses cumulative impacts over time and impacts from interacting stressors***
4. ***Little information for assessing trends in capacity of ecosystems to provide goods and services***
5. ***Growing need for information on responses of ecosystems to climate change***
6. ***Trends in abundance and other measures, such as reproductive success, available for only a few species groups***
7. ***Poor understanding of biodiversity status, trends, and ecological processes in some dominant biomes including aquatic ecosystems, wetlands, boreal forests, and coastal zones***
8. ***Poor monitoring coverage for less-populated and harder-to-access regions***

These key characteristics of policy-relevant research, as well as the information gaps listed above, highlight the need for long-term, coordinated, multidisciplinary research and monitoring, distributed widely across Canada's ecosystems. Biological field stations are among the most important platforms for addressing these needs.

IMPORTANCE OF FIELD STATIONS

Biological field stations are facilities or institutions that support place-based, multidisciplinary research over a sustained period. This broad definition encompasses both the large, formal stations that focus on particular issues such as forestry or agriculture as well as smaller, less formal field stations offering multiple research teams access to study sites. As infrastructure, this provision of access to the environment and logistical support for research and monitoring projects is one of the core benefits of field stations.

Canada is a sparsely inhabited country with predominantly public lands; accessing the environment for many types of biological field studies involves travel to remote locations. The facilities at field stations offer researchers cost-effective access to these locations, and importantly, access that is maintained over the long term. For terrestrial field stations, the support can include access to housing, access to vehicles, or controlled access to lands managed to achieve particular research objectives. In some cases, these lands are also protected through formal designations or stewardship agreements, so that field stations also offer a direct habitat conservation benefit. Safety from dangerous animals such as bears is a real concern in some locations, especially in the Arctic. Building and maintaining a secure research facility is expensive and sharing facilities at a field station is a cost effective means of ensuring the safety of research teams. Similarly, marine field stations offer access to vessels and other costly equipment that would be prohibitively expensive for individual research teams.

The logistical support offered by many field stations extends well beyond ease of access. Many offer storage facilities, laboratory space, and telecommunications infrastructure. This infrastructure allows researchers to bring elements of lab-based research into the natural environment, prepare or handle samples under controlled conditions and integrate advanced technology into field studies. Some provide meals and other services, allowing researchers to focus on their studies. Others provide permanent technical staff to assist with the use or maintenance of highly specialised equipment. Perhaps most importantly, though, field stations offer this access and logistical support over the long term.

The value of field stations as a platform for long term research cannot be overstated. The scientific benefits of longevity are many (see below), but the practical benefits are also substantial. Deployment and maintenance of sensors, collection of standardised samples, and carrying out of standardised ecological monitoring are all made significantly more cost-effective by association with an existing long term facility, where permanent staff or other collaborators can contribute to these value-added projects with small incremental costs.

The many logistical and practical benefits of field stations are substantial, but the real value lies in their contribution to improved science and education. Their unique contribution to science is twofold: 1) they act as foci for accumulation of site- or ecosystem specific knowledge (Billick and Price 2010), and 2) they foster an interdisciplinary community of scholars (Pi et al. 2012). This knowledge accumulated over time can have specific benefits; for example, knowledge of local natural history can aid in the development of relevant questions or the design of feasible studies. However, this accumulated knowledge can also have a more general and profound influence on the research.

The varied research projects carried out at field stations over time yields insights into numerous ecological processes, sometimes over long-time scales. Because these studies are linked to the specific field site, an understanding of interactions among ecosystem processes can develop and the site field emerges as a model ecosystem (Aigner and Koehler 2010), where research questions addressing complex interactions across spatial and temporal scales can be addressed. Ecological thresholds, natural ranges of variability, ecological responses to climate change, changing food web structures and other integrative issues in ecology can be addressed at field stations because of the long time series of varied data. In contrast, because they are not tied to a common place and time, single studies carried out in isolation do not allow for this level of inquiry. Accordingly, one study found that 26% of papers in the top-tier journal Ecology between 2005 and 2006 mentioned specifically that they arose from work carried out at field stations (Wyman et al. 2009).

The synergy achieved at field stations is also a product of the multidisciplinary community of scholars that use them. As in all branches of science, biological research becomes increasingly focussed as the discipline progresses. Still, many of the most innovative advances are made by linking observations and insights across disciplines, as Charles Darwin drew inspiration from the geological theories of Charles Lyell. Examples of this interdisciplinary cross-fostering at field stations are many. They may arise from or give rise to formal collaborative projects such the Hubbard Brook Ecosystem Study, where long-term, multidisciplinary studies of contaminants deposition and ecosystem effects have been instrumental in shaping policies on air pollution in the United States and Canada for decades (Driscoll 2011, 2012). Or, as is often the case, it can be more informal. Discussions among researchers over dinner at field stations around the world have contributed to innumerable “eureka moments”, and although impossible to quantify, this beneficial social and scientific exchange has led some to refer to field stations as “sites for serendipity” (Michener et al. 2009) or “places to learn the art of discovery” (Eisner 1982).

As “places to learn the art of discovery”, biological field stations play a critical role in science education and outreach. Curriculum-based field courses, field trips and a broad range of outreach activities are all based at field stations. These contribute greatly to the early training of highly qualified people and engender public support for conservation and the underlying science in a unique and unparalleled way. The role of field stations can become even more important as students progress in their academic career. For graduate students, senior undergraduate research interns, and post-doctoral researchers, field stations provide an opportunity to learn the practical skills of biological field work and offer a unique educational setting in which to interact informally with researchers from diverse fields. The impacts of this unique integration of research and education, in a natural setting, are profound.

There is considerable anecdotal evidence that research and educational experiences at field stations influenced the career decisions of many of today's scientists, conservationists and naturalists (Gladfelter 2002, Hodder 2009). Direct research experiences in particular have been linked to an improved understanding of the scientific process and recruitment into science careers (Hunter et al. 2007, Russell et al. 2007, Pi et al. 2012). It has been said that field stations are to the study of higher-order biological systems what research and teaching hospitals are to the medical sciences (Pi et al. 2012). In Canada, where universities shoulder an uncommonly high proportion of the country's applied research (top 5 among OECD countries, well ahead of the United States; OECD 2011), this contribution to the academic training of highly qualified people has an especially great societal importance.

CANADA'S CURRENT FIELD RESEARCH STATIONS

There are many field stations scattered across the Canadian landscape, from northernmost Nunavut to southern Ontario (Fig. 1). The field stations described here focus on or include biological, ecological, or environmental research, but many additional field stations focus on other themes. For a number of field stations, such as model forests, studies focus specifically on the ways in which these systems respond to human influences. For other stations, such as remote camps in the northern boreal forest or the Arctic, the intent is to describe ecological processes in their natural state.

Here, our focus is on stations where researchers interact directly with the environment. Larger laboratories, research centres and agricultural research stations in heavily settled locations are excluded, but admittedly, the distinction is fine in some cases; research facilities represent a continuum from small, remote outposts to large, advanced laboratories. Many biological field stations are affiliated with individual universities or government agencies, but some have memberships or consortia which include many institutions. Other lists of facilities including larger research centres, or facilities focussing on other themes are available elsewhere (e.g., http://www.ec.gc.ca/scitech/default.asp?lang=En&n=AEA51064-1, http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1181591790641&lang=eng, http://www.polarcom.gc.ca/index.php?page=northern-research-facilities&hl=en_US&facil=94).

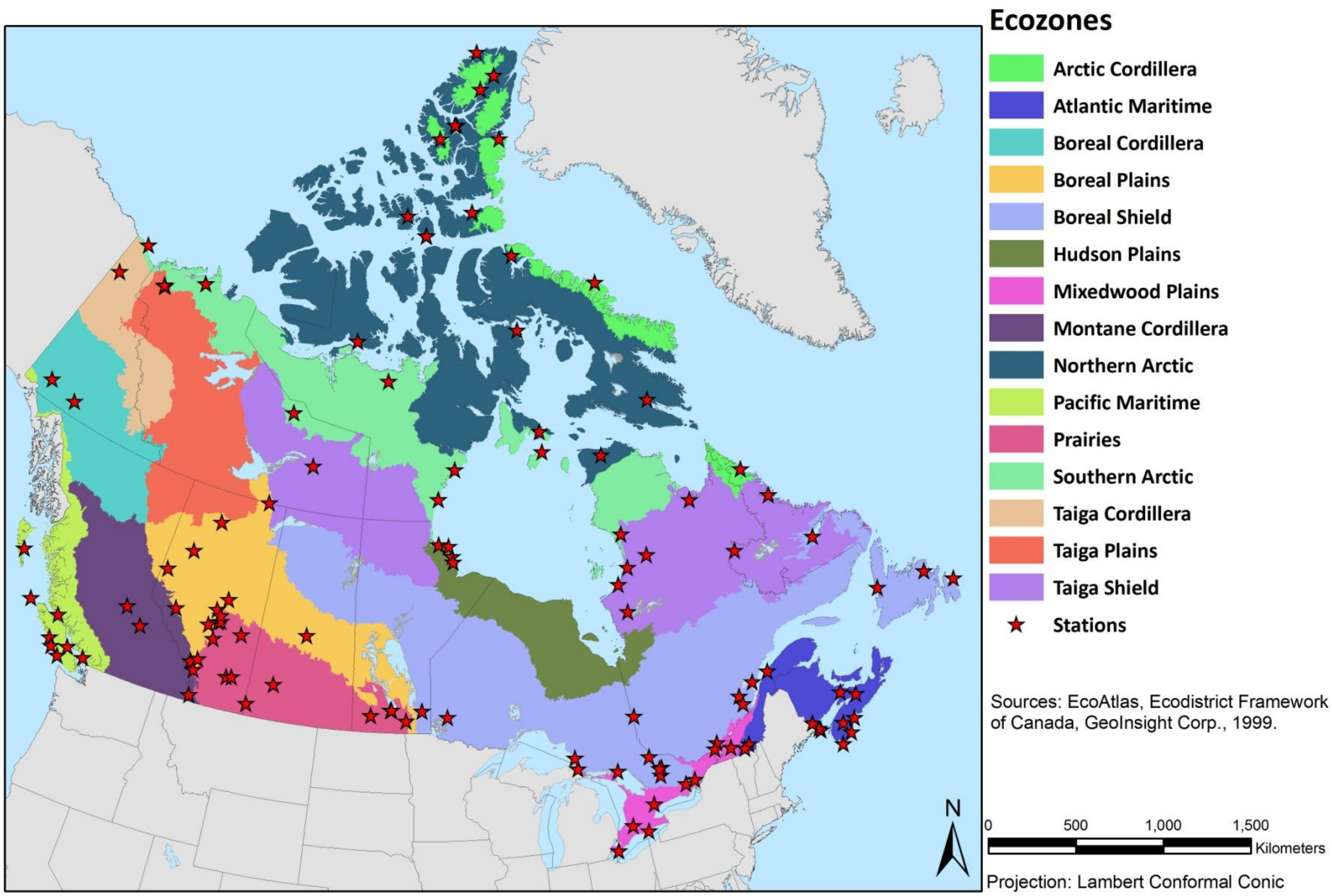

Figure 1. *The distribution of biological field stations relative to the boundaries of Canada's 15 terrestrial Ecozones.*

Profiles of some of Canada's biological field stations appear in Appendix 1. A survey was circulated to managers of these and other field stations to gather details of the level of research, training, and public outreach activities carried out. The 12 responses received represent only a small cross-section of the country's (larger) stations, but nevertheless give an indication of the level of activity. Among these, the Bamfield Marine Sciences Centre hosted the largest number of researchers and students in courses, over 500 per year, while other stations more typically hosted 100-500 (6 stations) or fewer than 100 (5 stations). Even among these larger stations, half had only a single station manager, and most (8 stations) had a seasonal staff of <10. Annual operating budgets were in excess of $500,000 for 5 stations, and $200,000-$500,000 for an additional 4. Despite the modest human capital and operating budgets, these 12 stations collectively offered in excess of 250,000 user days of research, education or outreach activity.

Field biology is largely a place-based enterprise and most field stations strive to serve as model ecosystems, reflecting processes of the system or biome in which they are situated. At a national level, the understanding of current ecosystem processes or prediction of future change would be improved if field stations were distributed across the full range of Canada's ecosystems. The National Ecological Framework for Canada (GeoInsight 1999) divides the country into 15 terrestrial and 5 marine Ecozones; distinct, ecologically coherent regions characterized by physiographic, climatic and biological variables. Through internet searches and correspondence with university representatives, we developed a list of 122 field stations, and the distribution of these stations relative to terrestrial Ecozone boundaries appears in Figure 1.

The spatial extent of these Ecozones varies widely, from 18% of the country's total terrestrial area for the Northern Arctic Ecozone to 1% for the Hudson Plains. The distribution of field stations per unit of Ecozone area suggests a relative overrepresentation of some Ecozones, such as Atlantic Maritimes, Montane Cordillera and Hudson Plains, and an underrepresentation of others, such as the Taiga Plains, the Boreal Plains, the Boreal Cordillera and the Northern Arctic (Fig. 2). However, area may not accurately reflect the diversity of ecosystem characteristics encountered; Ecozones are further subdivided into Ecoregions, which describe distinct natural landscape units at a finer scale. In terms of diversity of Ecoregions within Ecozones, the proportion of stations in the Taiga Plains, Boreal Cordillera, Taiga Cordillera and Prairies under-represents the diversity, while the proportion of stations in the Pacific Maritimes, Mixedwood Plains, Hudson Plains and Boreal Plains is an over-representation. Our list of field stations may not be complete, and Ecozones and Ecoregions may not accurately reflect the full diversity of ecosystem characteristics. Moreover, this relative distribution offers no insight into whether the total number of stations is adequate. However, assessments such as these could guide the placement of new field stations to design an optimal network for ecosystem monitoring and assessment or prediction of change.

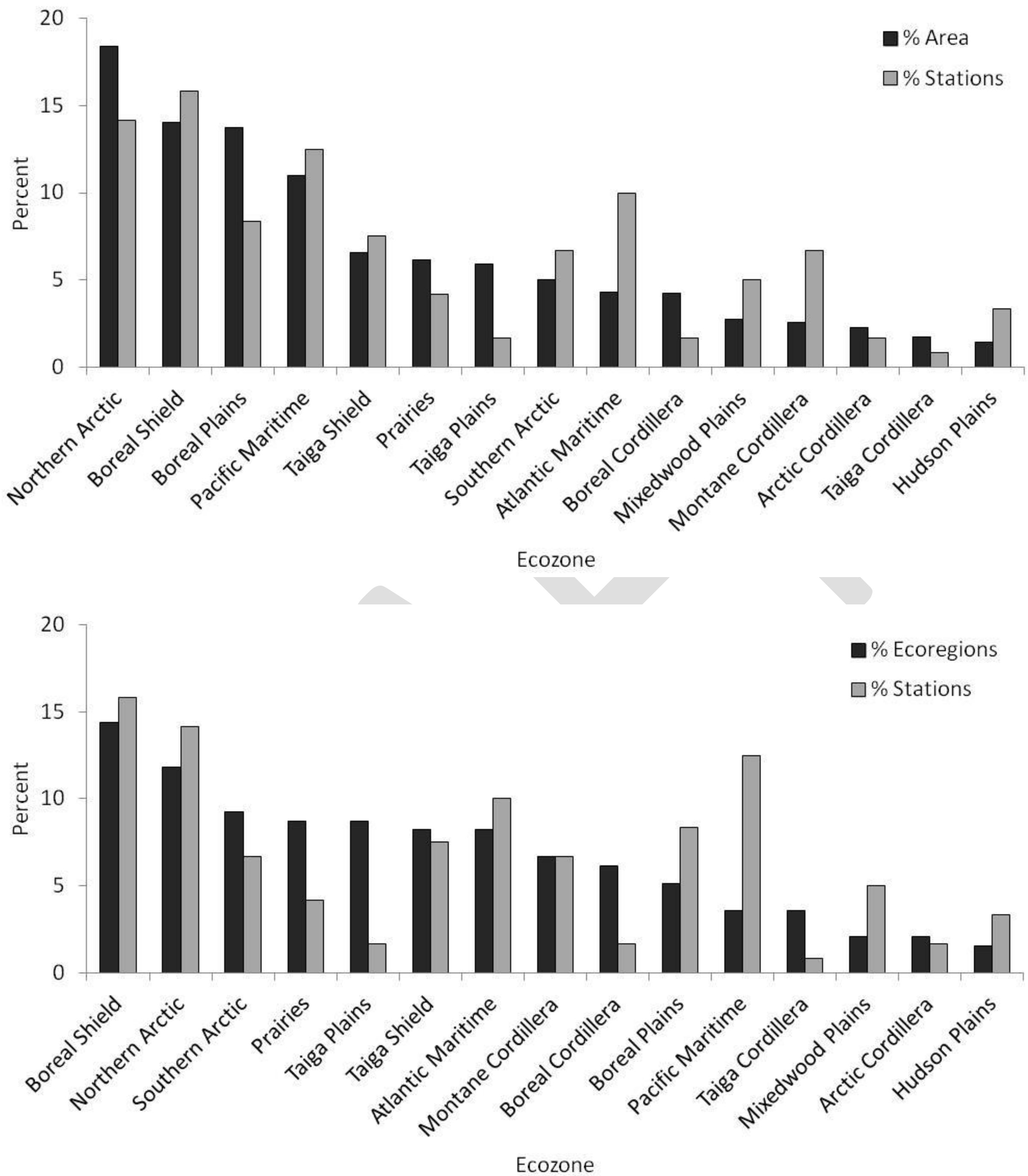

Figure 2. *The relative distribution of Canada's biological field stations among Ecozones, sorted by Ecozone area (top) and diversity of Ecoregions within Ecozone (bottom).*

FUNDING STATUS OF FIELD STATIONS

Despite the substantial and increasing importance of biological field research to society, and the clear contribution made to this research by field stations, these centres have faced significant financial challenges in recent years. This is despite apparent public support for field stations and the research that they facilitate. Indeed, recent cuts to the federal funding for several world-renowned research stations have garnered national media attention. For example, fully three quarters of Canadians were opposed to the recent funding cuts to the Experimental Lakes Area (Environics Research 2012), a leading centre for the study of impacts of acid rain, climate change and other anthropogenic influences on freshwater ecosystems. Regardless of the political context, sustainable funding for the operation of field stations is common concern among stations managers across the country.

Nearly 30 years ago, the Natural Sciences and Engineering Research Council (NSERC) developed policies allowing field station to access funding under infrastructure programs. NSERC programs such as the Major Resources Support (MRS) program became an important source of funding for many of Canada's biological field stations. Changes to this program in 2009-2010 reduced the scope, and field stations considered to be of regional (as opposed to national or international) significance were no longer eligible for support. In 2012, following cuts to and reallocation of NSERC's operating budget, the MRS program was suspended entirely.

A recent survey conducted by members of the Canadian Society for Ecology and Evolution found that 10 of the 17 biological field stations that responded had been previously awarded NSERC MRS support, and that these funds represented 8-50% of operating revenue. NSERC estimates that MRS provided an average of 15% of the operating budget of supported stations (including many outside of the biological sciences; President of NSERC S. Fortier in an interview to Research Money Inc., October 2012), so although loss of the MRS program represented a major blow to the funding of field stations in Canada, this is only one of many recent challenges. Stations face an increasing struggle to secure funding for capital expenditures to maintain the facilities. Several stations are currently evaluating new fee structures and alternative funding models to keep their doors open.

Without sustainable sources of funding, these stations, a significant capital investment in research infrastructure, are at risk of becoming inaccessible to researchers. A study initiated by the federal opposition critic for Science and Technology examined the impact of the suspension of the MRS program (including outside of the biological sciences). Twenty-eight of the 39 facilities (72%) receiving MRS support in 2011 responded to a questionnaire, and collectively, these facilities represent $2 billion in total capital investment, employ 533 staff members, trained a total of 5667 post-doctoral fellows, students, and technicians and assisted 9390 users in 2010-2011 (Stewart 2012). At least eight of these facilities are likely to close as a result of the cuts to the MRS program, representing loss of access to an $81 million investment in infrastructure for an annual savings of $1.3 million in MRS funding.

The figures above are drawn primarily from outside of the biological sciences, primarily because many biological field stations were dropped from the MRS program previously. However, the same issue applies universally to field stations. Sustainable funding is necessary to ensure continued access to valuable infrastructure. Moreover, in the biological sciences, sustainable funding ensures the continuity of long-term datasets; a priceless asset for detection and prediction of global environmental change.

LONG-TERM OPPORTUNITIES FOR SUSTAINABLE FUNDING

A reason cited by NSERC for the moratorium on the MRS program was that the relative contribution to total funding was small, that the current piecemeal approach of acquiring funding from numerous sources was inefficient and that the dissociation of the development of research infrastructure from its operation and maintenance was not best practice (President of NSERC S. Fortier in an interview to Research Money Inc., October 2012). Budget 2012 reduced the total allocation to NSERC and forced an increased emphasis on industry partnerships, at the expense of programs such as MRS. At the same time, the budget announced a $500 million allocation (beginning 2014-2015) to the Canada Foundation for Innovation (CFI), to support "the modernization of research infrastructure at Canadian universities, colleges, research hospitals and other not-for-profit research institutions across Canada" (Flaherty 2012), leading some to wonder if CFI may be the place to turn to fill the gap left by the MRS program.

Since its creation in 1997, the CFI has distributed $5 billion in funding in support of research infrastructure and equipment, with a total federal budget allocation of $1.25 billion in the 2009 and 2012 budgets alone (Flaherty 2012). This is an order of magnitude larger than the total expenditures under the MRS program since 2001 ($267 million, NSERC 2012). The CFI's Infrastructure Operating Fund allows for ongoing support to CFI funded infrastructure, but this is of little benefit to existing field stations. Moreover, current priorities of Canadian research funding agencies including CFI may place biological field stations at a disadvantage when competing for resources with other fields.

Recent trends in research funding have seen a shift towards industry partnerships and other direct means of improving Canada' embarrassing performance in the global race for innovation *sensu stricto*; Canada ranks 15th out of 18 comparator OECD countries in terms of labour productivity growth, a key metric of innovation and a key determinant of economic prosperity in the modern globalised economy (Expert Panel on Business Innovation 2009). This focus on technological innovation for the benefit of the economy is widespread through policies at all levels of government. However, Canada's environmental performance is equally embarrassing by the same yardstick, where we lag well behind most OECD comparator countries (except the United States; OECD 2004, OECD 2009). And if dollars are the unit of interest, it is becoming increasingly apparent that the long-term economic implications of climate change, biodiversity loss and other environmental damage may be far greater than previously believed. The effect of unabated climate change alone, for example, has been estimated at 5% of GDP annually (Stern 2007); a value larger than Canada's total annual GDP growth in all years since 1974 (World Bank 2012). And in stark contrast to substandard innovation, the economic implications of environmental degradation are difficult, and in some cases impossible, to reverse.

In order for policy makers and the public to appreciate the full value of work carried out at biological field stations, it is necessary for this message to be packaged and promoted. Tracking the contribution of field stations to undergraduate education, the development of highly qualified people and the role in fostering ground-breaking research does little to engender public appreciation and political will if the information goes only to funding agencies. Many stations are highly effective at promoting an appreciation for natural history or instilling a conservation ethic by reaching out to the public. However, they may be less effective at promoting appreciation for their contribution to science, society, and in particular, economy and human well-being. The stations themselves may not be the appropriate voice to promote this message at the national scale, but their work is at present undervalued relative to the critical role it can and does play in the pursuit of sustainable economic growth and human well-being.

SHORT-TERM OPPORTUNITIES FOR FUNDING

Effecting large scale change in policy is a slow process, and in the meantime, many field stations need a solution to their immediate financial concerns. The tightening budgets of research funding agencies have resulted in the loss of some of the previous sources of support for field stations, but core programs supporting individuals or teams of researchers, such as the NSERC Discovery Grants program, were expressly spared from the 2012 budget cuts. Thus, the relative share of research funding going to researchers has increased at the expense of the field stations supporting them. In the short term, field stations may wish to consider balancing their budgets by increasing user fees to achieve full cost recovery. A majority of field stations already charge user fees, typically as daily- or monthly rates, but alternative models such as overhead rates on grants for research carried at stations may serve to more realistically share the costs with the researchers using the facilities.

Alternatively, increased user fees could be addressed by new funding envelopes. For example, NSERC offers a Ship Time program to defray the extremely high costs of chartering research vessels, while researchers working in Canada's North have access to the Polar Continental Shelf Program to defray the costs of charter aircraft travel and to provide equipment and logistics support in the expensive and logistically challenging arctic research environment. Users of terrestrial field stations in most of Canada currently do not have access to any such support program, and the result is most commonly field stations that operate at a financial loss.

Some field stations could benefit from reaching out more to the public, to increase awareness and appreciation of the station's activities, and to perhaps to generate (small) amounts from donations or workshop fees. While many field stations already partner effectively with public environmental agencies, such as the Department of Fisheries and Oceans, Environment Canada, and others, comparatively few stations partner with industry. The strong government focus on research delivered in partnership with industry offers new avenues for funding; field stations have much to offer, from baseline environmental monitoring to advanced insights into ecological processes that can influence resource management policies. The Alberta Biodiversity Monitoring Institute (see: http://www.abmi.ca/abmi/home/home.jsp), while not a field station but rather a network of monitoring sites, offers a model for a successful monitoring and research endeavour delivered as a partnership of government, industry and academia.

In comparison to monitoring, fundamental ecological research is more difficult to integrate into such public sector or industry partnerships. Still, the concepts of maximising efficiency and elevating the level of the science by developing partnerships and networks are useful concepts for all biological field stations.

COORDINATION FOR MORE EFFICIENCY

In the United States, field stations are organised into several large-scale networks, such as the Long Term Ecological Research (LTER) Network: a primarily National Science Foundation (NSF) funded network of 26 sites across the Continental United States, Alaska, Antarctica and islands in the Caribbean and the Pacific. LTER was initiated in 1980 to provide the scientific expertise, research platforms, and long term datasets necessary to document and analyze environmental change. This internationally renowned network has been instrumental in advancing knowledge of ecosystem structure, function and response to change, and has produced a staggering 15,210 research publications since its inception (archived at: http://www.lternet.edu/bibliography/).

The LTER network will soon be joined by the National Ecological Observatory Network (NEON; http://www.neoninc.org/), now under construction. NEON is a network of 60 sites strategically selected from across the United States to represent different regions of vegetation, landforms, climate, and ecosystem performance. The core infrastructure of the network is an array of sensors, but these sensors are typically deployed at existing field sites where researchers can collect additional data describing the impacts of climate change, land use change and invasive species on natural resources and biodiversity. Funding for the network is from the NSF Major Research Equipment and Facilities Construction (MREFC) program, and the current annual budget is expected to be US$87-103 million during the construction phase (2012-2015) and approximately US$32 million thereafter (Neon Inc. 2012).

Similarly, the NSF funded Ocean Observatories Initiative is deploying a networked sensor array from the southern ocean southwest of Chile to the Irminger Sea, near Greenland, to study changing ocean conditions. These and other large-scale, coordinated research efforts have generated significant new funding because they promise to tackle the big questions.

These networks are not limited to the United States. The International Long Term Ecological Research project (see: http://www.ilternet.edu/), a self-described network of networks, includes member networks throughout the globe. Among these are the Chinese Ecosystem Research Network (CERN) comprising 36 permanent field stations distributed throughout China's various ecosystem, and the Terrestrial Ecosystem Research Network (TERN) of Australia. Importantly, there is currently no active network participating in Canada.

Canada has made some previous efforts to develop ecological monitoring networks, including the Forest Ecosystem Research Network of Sites (FERNS). FERNS was initiated by the Canadian Forest Service in 1997 to link medium to long-term silvicultural research sites that were representative of Canada's major forest ecosystems. While ostensibly aimed at bringing together forest researchers who were working largely independently at different experimental sites and improve sharing of information and technical transfer, the initiative was also intended to deflect criticism that Canada was not doing enough to understand the impacts of management on our vast and diverse forest ecosystems. The FERNS web site provided virtual housing for the network and links to the web sites of the various research sites but is no longer online. The legacy of the now defunct network consists of a collection of papers published in 1999 in a special issue of the Forestry Chronicle (vol.73, no. 3) following an international conference entitled *Long Term Silvicultural Research Sites: Promoting the Concept-Protecting the Investment.*

Another effort to develop a coordinated national network was made by Environment Canada in 1994: the Ecological Monitoring and Assessment Network (EMAN). EMAN was a response to the increasing awareness of the complexity, multiple scales and interdisciplinary nature of environmental problems, and its goal was to conduct long-term, multi-disciplinary research and monitoring related to changes in ecosystems (Brydges and Lumb 1998). These authors cited four main objectives of EMAN: 1) to provide a national perspective on how Canadian ecosystems are being affected by the multitude of stresses on the environment; 2) to provide scientifically defensible rationales for pollution control and resource management policies; 3) to evaluate and report to Canadians on the effectiveness of these policies; 4) to identify new environmental issues at the earliest possible stage. The network was discontinued in 2010 but a legacy of protocols, reports, and other resources is still available (archived at: http://www.ec.gc.ca/faunescience-wildlifescience/default.asp?lang=En&n=B0D89DF1-1).

Collaboration across stations increases the level of inquiry, and networks are inherently beneficial. Yet, both of these networks did not achieve their vision of coordinated monitoring sustained over the long-term. Both approached the issue of coordination in a somewhat post hoc fashion, by linking existing sites in the case of FERNS, or by encouraging the use of standardised protocols wherever or whenever monitoring was ongoing in the case of EMAN. Neither approach is inherently flawed and indeed a number of successful research networks in Canada and internationally operate largely on this model. An example is the coordination of northern research activities by the Canadian Polar Commission which facilitated the development of the Canadian High Arctic Research Station (CHARS). However, given the opportunity, a preferable approach is to design a coordinated network first and implement it second, as was done in the case of NEON.

Elsewhere in the world, coordinated networks of field stations are being looked to address the "Grand Challenges" in global sustainability (Reid et al. 2010, e.g., Pi et al. 2012), including: improving the usefulness of forecasts of future environmental conditions and their consequences for people, developing, enhancing, and integrating observation systems to manage global and regional environmental change, and determining how to anticipate, avoid, and manage disruptive global environmental change. As in other countries, field stations in Canada are uniquely equipped to address these challenges with existing long term datasets, valuable research infrastructure and priceless human capital.

CFRNET: COORDINATED RESEARCH AND A COMMON VOICE

Biological field research in Canada could benefit from a more coordinated, networked approach to maximise its value by addressing questions at a bigger spatio-temporal scale. The stations supporting this research could benefit from a coordinated approach to express their value to policy makers and the public. Both functions could be served by an organisation that unites field stations across Canada, fosters collaboration and promotes the benefits of stations' activities. The Canadian Field Research Network, CFRnet, is an organisation proposed by the directors of some of Canada's largest and most successful field stations that could serve these functions.

Vision Statement:

To facilitate and promote understanding of Canada's natural legacy in a changing world through field research, training and outreach

Mission Statement:

To foster and coordinate field research, training and outreach in Canada through a network of member facilities

CFRNet will do this by:

1. ***Providing facilities that support cost-effective world-class field research across Canada***
2. ***Fostering the next generation of experts who will be called upon to solve Canada's most pressing environmental problems***
3. ***Building and maintaining long-term studies crucial in valuing and sustaining Canada's natural capital***

The vision for CFRnet includes a national network of field stations to provide a secure, long term base for research in all of Canada's diverse Ecozones. By defining *a priori* some of the key questions that the network will address, and devising a formal sampling plan to address these questions most efficiently, CFRnet offers a vision of collaboration for maximum value. Enhancing the use of existing field stations forms an important part of this vision, but new stations allocated strategically throughout Canadian Ecozones is a long-term goal. With standardized monitoring protocols, a strategic distribution of research sites, and an a priori effort to formalize the information needs and the approach to filling them, CFRnet responds to the Ecosystem Status and Trends Report finding that:

> ***"The mosaic of information, reflected in the gaps in this assessment…can only be resolved through attention to setting policy-relevant monitoring priorities and to design and consistent operation of long-term monitoring systems… Assessment capacity can be improved through maintaining and building on existing long-term monitoring, but new initiatives may be required to meet policy needs." (Government of Canada 2012)***

CFRnet would provide a centralized repository for management, archiving of and access to field station data; an increasingly important task as the volume of digital information produced by researchers grows exponentially. Building on Canadian information technology innovations such as Canada's Advanced Research and Innovation Network (CANARIE), CFRnet would drastically improve accessibility to data, data standardization, and opportunities for high-level analytical syntheses. In this way, CFRnet responds to the Ecosystem Status and Trends Report finding that:

> ***"Information management is crucial to the integrity, long-term usefulness, and accessibility of monitoring results. Effective monitoring programs include organization and documentation of datasets, secure storage in long-term, searchable archives, and regular review and quality checks. With advances in technology, datasets have become larger and***

more complex, thereby requiring more resources to manage. At the same time, techniques for analyzing data spatially and for sharing data across networks present opportunities for viewing and synthesizing environmental information in new ways – and also increase the need for coordinated data policies and standards." (Government of Canada 2010)

The Organisation of Biological Field Stations (OBFS) has successfully served a similar role for field stations of the United States since 1966, and while an International Organisation of Biological Field Stations (IOBFS) was established in 1989, national or regional networks of field stations are recognised as instrumental for linking field stations with governments and the public at the appropriate scale (Wyman et al. 2009). Several successful regional networks of field researchers and stations already exist in Canada, including the Centre D'Études Nordique (http://www.cen.ulaval.ca/en/page.aspx?lien=index), ArcticNet (http://www.arcticnet.ulaval.ca/), and the developing Canadian High Arctic Research Station (http://www.aadnc-aandc.gc.ca/eng/1314731268547/1314731373200), as well as more focussed collaborative networks such as the International Tundra Experiment (http://www.geog.ubc.ca/itex/index.php).

CFRnet is envisioned as an umbrella under which these efforts can be united, with a specific focus on promoting collaboration across disciplines at the national scale, developing and maintaining facilities that allow for long term research and monitoring, and offering a common voice for the promotion of the value of biological field research, terrestrial and marine, to Canada's policy makers. This common voice may be what is required to ensure long term funding to sustain Canada's network of field stations. And undoubtedly, the coordinated research across the network is necessary to ensure ecological sustainability in the face of global environmental change.

LITERATURE CITED

Aigner, P.A. and C.E. Koehler. 2010. The model ecosystem as a paradigm of place-based research: the intersection of geology, ecology, and economics at the McLaughlin Reserve. Pages 359-381 in I. Billick and M. V. Price (eds.). The ecology of place: contributions of place-based research to ecological understanding. University Of Chicago Press, Chicago.

Anielski, M. and S. Wilson. 2005. Counting Canada's natural capital: assessing the real value of Canada's boreal ecosystems. Canadian Boreal Initiative and the Pembina Institute, Ottawa, Ontario and Drayton Valley, Alberta. 78pp.

Berkes, F. 2012. Implementing ecosystem-based management: evolution or revolution? Fish and Fisheries 13: 465-376.

Billick, I., and M. V. Price (eds.). 2010. The ecology of place: contributions of place-based research to ecological understanding. 480 pp. University Of Chicago Press, Chicago.

Butchart, S.H.M., Walpole, M., Collen, B., van Strien, A., Scharlemann, J.P.W., Almond, R.E.A., Baillie, J.E.M., Bomhard, B., Brown, C., Bruno, J., Carpenter, K.E., Carr, G.M., Chanson, J.S., Chenery, A.M., Csirke, J., Davidson, N.C., Dentener, F., Foster, M., Galli, A., Galloway, J.N., Genovesi, p., Gregory, R., Hockings, M., Kapos, V., Lamarque, J.-F., Leverington, F., Loh, J., McGeoch, M.A., McRae, L., Minasyan, A., Morcillo, M.H., Oldfield, T.E.E., Pauly, D., Quder, S., Revenga, C., Sauer, J.R., Skolnik, B., Spear, D., Stanwell-Smith, D., Stuart, S.N., Symes, A., Tierney, M., Tyrrell, T.D., Vie, J.-C. and Watson, R. 2010. Global biodiversity: indicators of recent declines. Science 328:1164-1168. doi:10.1126/science.1187512.

Brydges, T., and Lumb, A. 1998. Canada's Ecological Monitoring and Assessment Network: Where we are and where we are going. Ecological Monitoring and Assessment 51 (1-2): 595-603.

Cardinale, B. J., J.E. Duffy, A. Gonzalez, D.U. Hooper, C. Perrings, P. Venail, A. Narwani, G.M. Mace, D. Tilman, D.A. Wardle, A.P. Kinzig, G.C. Daily, M. Loreau, J.B. Grace, A. Larigauderie, D.S. Srivastava, & S. Naeem. 2012. Biodiversity loss and its impact on humanity. Nature 486: 59-67.

Costanza, R., d'Arge, R., deGroot, R., Farber, S., Grasso, M.,Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., and van den Belt, M. 1997. The value of the world's ecosystem services and natural capital. Nature 387, 253–260.

Driscoll CT, Lambert KF, Weathers KC. 2011. Integrating science and policy: A case study of the Hubbard Brook Research Foundation Science Links program. BioScience 61: 791–801.

Driscoll, C.T., K.F. Lambert, F.S. Chapin, D.J. Nowake, T.A. Spies, F.J. Swanson, D.B. Kittredge, and C.M. Hart. 2012. Science and society: the role of long-term studies in environmental stewardship. BioScience 62: 354–366.

Eisner, T. 1982. For love of nature: exploration and discovery at biological field stations. BioScience 32: 321-326.

Environics Research. 2012. Omnibus attitudes towards cancellation of ELA funding – October 2012. Environics Research Group, Unpublished Report.

Expert Panel on Business Innovation. 2009. Innovation and business strategy: why Canada falls short. Council of Canadian Academies, Ottawa, Canada. Avaialble at: http://www.scienceadvice.ca/uploads/eng/assessments%20and%20publications%20and%20news%20releases/inno/(2009-06-11)%20innovation%20report.pdf

Federal, Provincial and Territorial Governments of Canada. 2010. Canadian Biodiversity: Ecosystem Status and Trends 2010. Canadian Councils of Resource Ministers. Ottawa, ON. vi + 142 p.

Flaherty, J.M. 2012. Jobs, growth and long-term prosperity: economic action plan 2012. Public Works and Government Services Canada, Ottawa. 498 pp.

Franklin JF, Cromack K, Denison W, McKee A, Maser C, Sedell J, Swanson F, Juday G. 1981. Ecological characteristics of old-growth Douglas-fir forests. Portland (OR): US Department of Agriculture Forest Service, Pacific Northwest Forest and Range Experiment Station. General Technical Report PNW-118.

Franklin JF, Perry DA, Schowalter TD, Harmon ME, McKee A, Spies TA. 1989. The importance of ecological diversity in maintaining long-term site productivity. Pages 82–97 in Perry DA, Meurisse R, Thomas B, Miller R, Boyle J, Means J, Sollins P, eds. Maintaining the Long-term Productivity of Pacific Northwest Forest Ecosystems. Portland (OR): Timber Press.

Gladfelter EH. 2002. Agassiz's legacy: scientists' reflections on the value of a field experience. Oxford University Press.

Gunton, T. And K.S. Calbick. 2010. The maple leaf in the OECD: Canada's environmental performance. David Suzuki Foundation and School of Resource and Environmental Management, Simon Fraser University. 45 pp. Available at: http://www.davidsuzuki.org/publications/downloads/2010/OECD_Report_Final.pdf

Hodder, J. 2009. What are undergraduates doing at biological field stations and marine laboratories? BioScience 59: 666-672.

Hunter A-B., S. L. Laursen, and E. Seymour. 2007. Becoming a scientist: The role of undergraduate research in students' cognitive, personal and professional development. Science Education 91: 36–8 74.

Michener, W.K., K.L. Bildstein, A. McKee, R.R. Parmenter, W.W. Hargrove, D. McClearn, and M. Stromberg. 2009. Biological field stations: research legacies and sites for serendipity. BioScience 59: 300-310.

Miles, R.N., Su, Q., Cui, W., et al. (2009). A low-noise differential microphone inspired by the ears of the parasitoid fly Ormia ochracea. Journal of the Acoustical Society of America, 125, 4, 2013-2026.

Mora, C., D.P. Tittensor, S.A. Alastair, G.B. Simpson, and B. Worm. How many species are there on Earth and in the ocean? PLOS Biology 9: e1001127. doi:10.1371/journal.pbio.1001127.

National Snow and Ice Data Centre. 2012. Arctic sea ice news and analysis: open water means a warm Arctic. Avaialable at: http://nsidc.org/arcticseaicenews/. Accessed Oct 30, 2012.

NEON Inc. 2012. Success for NEON: A $433M Slot in Obama's Budget Plans. Available at: http://www.neoninc.org/news/485

Organisation for Economic Cooperation and Development, (OECD). 2004. Environmental performance reviews: Canada. Paris: OECD Publications.

Organization for Economic Cooperation and Development (OECD). 2009. OECD Environmental Data Compendium. Online: www.oecd.org/document/49/0,3343,en_2649_34441_39011377_1_1_1_1,00.html

OECD - Organisation for Economic Co-operation and Development. 2011. Statistics accessed at: http://www.oecd.org/document/0,3746,en_2649_201185_46462759_1_1_1_1,00.html

OMNR. 2010. Forest management guide for Great Lakes – St. Lawrence forests. Toronto: Ontario Ministry of Natural Resources, Queen's Printer for Ontario, Toronto. 78 pp.

Pi, I.B., I. Babb, B. Kloeppel, J.C. Leong, J. Hodder, J. Sanders, H. Swain. 2012. Building and operating the field stations and marine

laboratories of the future: a strategic planning report. Unpublished report to the Organization of Biological Field Stations. Available at: http://fsmlfuture.weebly.com/uploads/7/6/7/3/7673279/fsml_final_report_8.13.2012.pdf

Pikitch, E.K. E.A., Santora, A. Babcock, A. Bakun, R. Bonfil, D.O. Conover, P. Dayton, P. Doukakis, D. Fluharty, B. Heheman, E.D. Houde, J. Link, P.A. Livingston, M. Mangel, M.K. McAllister, J. Pope, and K. Sainsbury. 2004. Ecosystem-based fishery management. Science 305: 346-347.

Reid, W.V., D. Chen, L. Goldfarb, H. Hackmann, Y.Y. Lee, K. Mokhele, E. Ostrom, K. Raivo, J. Rockstrom, H.J. Schellnhuber, and A. Whyte. 2010. Earth system science for global sustainability: Grand challenges. Science 330: 916-917.

Russell, S. H., M. P. Hancock, and J. McCullough. 2007. The pipeline: Benefits of undergraduate research experiences. Science 27: 548–549.

Schaefer, M.B. 1954. Some aspects of the dynamics of populations important to the management of the commercial marine fisheries. Bulletin of the Inter-American Tropical Tuna Commission 1: 25-56.

Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.). 2007. The Physical Science Basis. Contribution of Working Group I to the Fourth

Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Soulé, M. 1985. What is conservation biology? Bioscience 35:727-734.

Stewart, K. 2012. Pennywise, pound foolish: Major Resources Support program moratorium impact report. Office of Kennedy Stewart, MP, Official Opposition Critic for Science & Technology, August, 2012. Unpublished report, available at: http://www.cins.ca/docs/mrs_program_moratorium_impact_report.pdf.

Stern, N. 2007. The economics of climate change: the Stern review. Cambridge University Press, Cambridge. 712pp.

Tan, G., C. Gyllenhaal, and D.D. Soejarto. 2006. Biodiversity as a source of anticancer drugs. Current Drug Targets 7:265-277.

Webb, H.K., J. Hasan, V.K. Truong, R.J. Crawford, and E.P. Ivanova. 2011. Nature inspired structured surfaces for biomedical applications. Current Medical Chemistry 18:3367-3375.

Worm B, Barbier EB, Beaumont N, Duffy JE, Folke C, Halpern BS, Jackson JBC, Lotze HK, Micheli F, Palumbi SR, Sala E, Selkoe KA, Stachowicz JJ, Watson R. 2006. Impacts of Biodiversity Loss on Ocean Ecosystem Services. Science 314: 787-760

Wyman, R. L., Wallensky, E., and Baine, M. 2009. The activities and importance of international field stations. Bioscience 59:584-592.

APPENDIX 1. PROFILES OF SELECTED CANADIAN BIOLOGICAL FIELD RESEARCH STATIONS

Wildlife Research Station (WRS) - Algonquin Park
Location: Algonquin Provincial Park - HWY 60 corridor
Director - Albrecht Schulte-Hostedde, Dept of Biology, Laurentian University
Manager - Rory Eckenswiller (705) 633-5621, email: wrs@vianet.ca
WRS website - http://www.uoguelph.ca/~wrs/home.html

The Wildlife Research Station (WRS) in Algonquin Provincial Park was established in 1944 for the long-term study of terrestrial ecology in a representative tract of the Great Lakes-St. Lawrence (GLSL) forest region, with access to coniferous, mixed and northern hardwood forests. This area is now part of a large wilderness zone within Algonquin Park, and is unique in that it lacks canoe routes, active forest management, logging roads, or public access. Algonquin Park contains unparalleled biodiversity in Canada because it is a transition zone between northern and southern fauna and flora. The WRS has been used extensively since its establishment by a large number of research scientists, wildlife biologists and university field course participants. There are several long-term data-bases that have arisen from research at the station on diverse wildlife species, such as small mammals, passerine birds, biting insects, reptiles, amphibians, parasitic organisms, and fungi. In addition, WRS provides unique training and educational experiences to both undergraduate and graduate students in the life sciences from a variety of Universities

The property of the WRS is part of a provincial park, and is therefore owned by the Ontario Ministry of Natural Resources (OMNR), but the WRS facilities are operated and administered by a consortium of six Ontario Universities. The station provides access to a 400 km² forested "wilderness zone" protected from anthropogenic disturbances; this area contains a variety of terrestrial habitats, numerous headwaters, and several lakes and streams that are the research foci of 9 major users and several minor users from various Universities across Ontario. In addition, there are minor International researchers who have used the station because it is such a unique research venue on the Canadian Shield. The WRS has entered an expansion and renewal phase: fundraising initiatives are being designed to enhance and expand the current infrastructure; the station is now open year round to accommodate winter research use; and, in addition to long standing Major Users Fiona **Hunter** (Brock) and Ron **Brooks** (Guelph), there are several newer Major Users including Andrew**McAdam** (Guelph), Ryan **Norris** (Guelph), Glenn **Tattersall** (Brock), Scott **Ramsay** (Laurier), Albrecht **Schulte-Hostedde**(Laurentian), and Erica **Nol** (Trent).

Queen's University Biological Station

Location: Lake Opinicon, 50km north of Kingston, ON 44deg30.8minN, 76deg19.4minW
Director: Dr. Bruce Tufts, Dept of Biology, Queen's University
Manager: Frank Phelan, QUBS
Biome Represented: Great Lakes-Saint Lawrence Forest Region; Rideau Lakes; Frontenac Arch/Frontenac Axis
Contact Information: Frank Phelan, Queen's University Biological Station, 280 Queen's University Road, RR #1, Elgin, Ontario, Canada, K0G 1E0
Telephone: 613-359-5629 Fax: 613-359-6558
E-mail: phelanf@queensu.ca or tuftsb@queensu.ca
Website: http://www.queensu.ca/biology/qubs.html

Affiliation: University Field Station - Queen's University

Suite of Users: Queen's University, University of Ottawa, Carleton University, University of Toronto, University of Western Ontario, University of Windsor, Ithaca College, Trinity University (Texas), llinois Natural History Survey (Champaign, Illinois), University of Illinois and others. Partner in Ontario Universities Program in Field Biology.

Amenities: 2,762 ha of property under direct ownership; Operations Centre, meals, labs, lodging (cap. 91), boats and motors, ATVs, refrigerators, freezers, scales,some sampling equipment, weather station, high-speed wireless, GIS/GPS; Outreach programs;

Lac Duparquet Research and Teaching Forest Research Station
Location: 488 chemin du Balbuzard (C.P 460), Rapide-Danseur, QC J9Z 3G0
50km northwest of Rouyn-Noranda (approx. 48°30' N, 79°22' W)
Research Forest Director: Dr. Brian Harvey, Applied Sciences Department, Université du Québec en Abitibi-Témiscamingue (UQAT)
Station Manager: Raynald Julien
Biome Represented: Boreal Shield Ecozone; Western balsam fir-white birch bioclimatic domain (Quebec classification)
Contact Information: Brian Harvey, UER Sciences appliquées, UQAT, 455 boulevard de l'Université, Rouyn-Noranda, QC J9X 5E4
Telephone: 819-762-0971 ext. 2361 Fax: 819-797-4727
E-mail: brian.harvey@uqat.ca
Website: http://ferld.uqat.ca/

Affiliation: University research forest and station: UQAT & Université du Québec à Montréal (UQÀM)

Suite of Users: Concordia U., McGill U, MacDonald College, U. de Montréal, U. Sherbrooke, UQAC, UQAR, U. Laval, UNB, U, Alberta, Canadian Forest Service, Institut de Botanique, Montpellier, U. North Carolina, U. Wisconsin, Beijing Forestry U., Swedish Agricultural U. in Alnarp,

Amenities: 9,401 ha of Crown Land under long-term lease (1/4 zoned conservation for long-term environmental monitoring;3/4 under adaptive ecosystem-based and intensive forest management); Commercial & experimental forest harvesting and long-term research; Research station (cap.35) contains 2 basic field labs, a dendroecological lab, refrigerators, freezers, drying ovens, scales, etc., meteorological station, high-speed, wireless internet, boats & motors, ATVs, snowmobiles, trailers, etc. Cafeteria service May-Sept. Graduate field courses; occasional research workshops & tech. transfer activities; interpretive and hiking trails.

Koffler Scientific Reserve at Jokers Hill
Location: 50km north of Toronto 44deg03.0minN, 79deg32.0minW
Director: Dr. Art Weis, University of Toronto
Associate Director for Education and Outreach: Dr. Robin Marushia, University of Toronto-Scarborough
Reserve Manager: John Jensen, KSR
Biome Represented: Great Lakes-Saint Lawrence Forest Region; old-field;
Contact Information: Dr. Art Weis, Koffler Scientific Reserve at Jokers Hill 17000 Dufferin Street, King City ON L7B 1K5
Telephone: 905-727-3333
E-mail: ksr.info@utoronto.ca
Website: http://ksr.utoronto.ca/

Affiliation: University Field Station – University of Toronto

Suite of Users: University of Toronto, University of Toronto-Scarborough, University of Toronto-Mississauga, York University, University of Guelph, Trent University, University of Windsor, Carleton University, Universite Bordeaux, Universite Paris-Orsay, University of Pittsburgh, Cornell University, Czech Academy of Science; Partner in Ontario Universities Program in Field Biology. Offices and meeting centre for the Canadian Institute of Ecology and Evolution.

Amenities: 350 ha of property under direct ownership featuring 4 ha old growth hardwood, 150+ ha of maturing second growth (maple, beech, hemlock) and pine plantations, 100 ha of old-fieds and 4 ponds (one fish-less); Laboratory for Biodiversity and Global Change Biology; dissecting and compound microscopes; analytical and microbalance; freezers; drying ovens, weather station; DNA extraction and amplification lab; high-speed wireless; farm equipment; seasonal greenhouse; Experimental Climate Warming Array; classroom and teaching lab; lecture/conferences rooms; housing for up to 30.

Outreach programs: annual program of Nature Walks and Natural History Workshops; The Naturalist Training Course (offered through the University of Toronto School of Continuing Studies); hiking trails.

Bamfield Marine Sciences Centre

Location: West Coast of Vancouver Island (48deg50.09min N; 125deg08.31min W)
Director: Dr. Brad Anholt, University of VictoriaResearch
Coordinator: Dr. David RiddellUniversity
Programs Coordinator: Ms Beth RogersPublic
Education Program: Ms Anne Stewart
Biomes Represented: Temperate Coastal Rainforest, Pacific nearshore marine
Postal Address: Bamfield Marine Sciences Centre, 100 Pachena Road, Bamfield, BC V0R 1B0Telephone: 250-728-3301
E-mail: info@bms.bc.ca
Website: http://bms.bc.ca

Affiliation: Western Canadian Universities Marine Sciences Society - made up of:University of AlbertaUniversity of CalgaryUniversity of British ColumbiaSimon Fraser UniversityUniversity of VictoriaUsers: Researchers come from every Canadian Province, except Prince Edward Island (so far), 18 US universities and a dozen other countries. Over the last 2 years 66 different research groups have worked at BMSC, with 93 graduate students, 30 PDFs, and 47 technicians. This generates over 60 peer-reviewed publications per year. University courses are taught over 18 weeks in the summer. In 2010 197 students attended 15 different courses for 24 full-time equivalents. The fall program is a full semester of 5 marine biology classes for 24 students. Students come primarily from the member universities but we had students from Oxford, New Zealand, Mexico, Germany, the Netherlands, Greece, and a 15 student exchange from Taipei. Our Public Education Program sees 4,000 K-12 students every year mostly from BC and Alberta. These students spend several days learning about the marine realm and conservation biology.

Facilities: BMSC is situated on 90 ha on a point between two inlets. We also own a 5 ha tract of old-growth coastal cedar forest. It is available to researchers 12 months a year. University programs run May to December with additional field trips handled by the Public Education Program. Public Education runs from late February to June, and again from September to November.

Laboratory space - 3000 sq m in 5 buildings. A flow through sea-water system capable of 1000 L / min to provide unfiltered sea water through the entire site. 118,000 L freshwater storage, two 80 m deep wells, and a dechlorinator for supplementation with domestic water. A 12 m flume equipped with laser particle velocimeter for hydrodynamics and biomechanics. Confocal microscope and fluorescence scope. High magnification stereoscope. Scintillation counter, atomic absorption spectrophotometer, plate reader, centrifuges, water baths. A research vessel (13m), a dive tender (10 m), 2 skiffs (8 m), 6 additional vessels for field work. A dive shed with storage, and air compressor. Underwater ROV. 1000 sq m of aquaria space, a 4m deep 12 m across tank for keeping large fish, primarily dogfish. A high speed computer network with wireless LAN throughout.

Housing - Eight fully-equipped townhouses (including kitchens) can accommodate 60 researchers. Renovations to the seaside dorms will provide an additional 12 beds for researchers at peak times and the 98-bed Buchanan Lodge provides overflow capabilities and undergraduate housing. The permanently staffed cafeteria can serve 120 diners per sitting (more at a pinch).

Staff - 30.5 full-time staff. Director, business manager, front office (2), University Programs (1.5), Research (1.5), IT, Public Education (2), Electrician, Maintenance (4), Kitchen (6), Housekeeping (4), Foreshore (3), Animal Care (1.5), Library, and an additional 10-15 casual staff depending on demand.

Outlook: BMSC has 40 years of research history and a collections database going back to its inception. Our plan is to serve these data in a public database to be used as a platform for global change research. We will be capturing additional data from long-term research projects and also making these available on a public platform. We will be using the precepts of the Dryad initiative to insist that data be made publicly available as early as possible. In addition we have written grants to establish a network of sensors to provide the data that myriad researchers need in the marine realm. Our initial approach will be to use loggers but will eventually move to real time acquisition. The goal is to provide the data platform that makes BMSC irresistible as a research site for anyone doing work in the marine nearshore. At the same time still providing the services required by our comparative biochemists and physiologists.

Meanook Biological Research Station
Universirty of Alberta, Department of Biological Sciences
Located 1.5 hours North of Edmonton near Athabasca, Alberta
Academic Director: Dr. Heather Proctor
On-site Manager: Brandon Nichols (bnichols@ualberta.ca)

MBRS is a year round research and education facility which provides accommodations and laboratory access to researchers, students and non-profit groups. On 520 acre facility, located in the transition zone between the aspen parkland and the boreal mixedwood forest of Northern Alberta, it offers large study areas, experimental ponds, walking trails and an abundance of wildlife. Recent research includes work on peatland carbon cycles, amphibian and fish population ecology, and dynamics of tent catepillar outbreaks. MBRS hosts a variety of eco-tours and educational field trips for groups of all ages and education levels. It provides facilities for the Alberta Biodiversity Monitoring Institute.

Harkness Laboratory of Fisheries Research
Location: Lake Opeongo, Algonquin Park, Ontario
Director: Mark Ridgway
Biologist: Trevor Middel
Senior Technician: Gary Ridout
mark.ridgway@ontario.ca
website: www.harkness.ca (check the website for amenities, background and scope)

Affiliation: Ontario Ministry of Natural Resources

Users: University of Toronto (Erindale, St. George & Scarborough campuses), Trent University, McMaster University, and scientists from OMNR and DFO. Recent past users include McGill University and University of Guelph.
Seasonal Telephone: 613-637-2103 (Algonquin Park)
Main Telephone: 704-755-1550 (Peterborough at Trent University)

Biomes: Lake ecosystems on Canadian Shield landscapes and within post-glacial Great Lake drainage systems.

Research at Harkness is focused on aquatic ecology and at times terrestrial ecology. Recent research as focused on population ecology of fish and mammals, habitat selection, food web structure, genetic structure of populations, and lake ecosystem productivity. Topics span basic ecological questions through to applied questions related to sustainability of fisheries and other policy/management priorities.

Churchill Northern Studies Centre
Location: 23 km east of Churchill, Manitoba on the site of the former Churchill Research (Rocket) Range 58 44.16N 93 49.09W
Established: 1976

Land: the CNSC operates, under Provincial crown-land permit, in the Churchill Wildlife Management Area. We own the land our buildings are located on, but I've never sat down to work out the land area.

Address: Box 610, Churchill, Manitoba R0B 0E0 (204) 675-2307 tel. (204) 675-2139 fax
Website: www.churchillscience.ca Annual report:www.churchillscience.ca/documents/CNSC_Annual_Report_2010-WEB.pdf

Biomes: sub-arctic tundra - boreal forest transition zone, marine, estuary, Hudson Bay Lowlands

Affiliation: Independent, non-profit, registered Canadian charity

Users: Between 8000-9000 user days (user day = one overnight stay) per year. Local, regional, national and international researchers, government agencies, general public, youth groups, etc.
Operating Budget: ~ $1.2 million (proportion of operating budget from government sources = < 10% from the Province of Manitoba)

Staff: 7 full-time, 6-8 seasonal
Board: 17 members representing academia, government and the community of Churchill
Director: Michael Goodyear goodyear@churchillscience.ca
Assistant Director: Heidi den Haan (formerly of Delta Marsh Field Station - before it closed last fall and she was laid off) denhaan@churchillscience.ca
Scientific Coordinator: Dr. LeeAnn Fishback fishback@churchillscience.ca

Facilities: ~ 26, 000 sq. ft (existing facilities) with another 28,000 sq. ft. (currently under construction - opening date June 1, 2011). Accommodations for 92, full kitchen/cafeteria, three classrooms, clean dry and wet labs, dirty dry and wet labs, secure lab, audio-visual lounge, aurora viewing dome, fitness room, barrier free, LEED GOLD design. The CNSC maintains a fleet of over 30 vehicles ranging from snowmobiles and ATVs to 40-passenger buses, suburbans, pick-ups and front-end loaders.

Research Focus: The CNSC supports a broad range of research in the biological, physical and social sciences. Of particular focus are long-term environmental monitoring, climate processes, wildlife population ecology, aurora, biodiversity, migratory waterfowl, permafrost, effects of climate change, etc. Contract research services are provided to a wide variety of government and university clients for the maintenance of equipment and the transmission of data.

Educational Programming: school groups, university credit courses, and general interest non-credit "Learning Vacations" offered both through the CNSC brand and Elderhostel.

Outlook: The CNSC has been extremely successful accessing funding for infrastructure improvements, but virtually no opportunities exist for securing additional operating funding. Current operating funds are derived from user fees, educational programming, and member donations. The CNSC has never been able to fully recover from the loss of our $80K NSERC-MRS grant several years ago. With the seasonal closure of Delta Marsh Field Station, the CNSC is now Manitoba's only year-round, full-service biological field station. New building opens for use June 1, 2011 after 18 months of construction and a cost of $17.2 million. Every building system/technology was chosen to reduce long-term operating costs.

Gault Nature Reserve

422 Chemin des Moulins, Mont-Saint-Hilaire, Quebec J3G 4S6
Phone: 450 467-4010; Fax: 450 467-8015; E-Mail: info.gault@mcgill.ca
Website: http://www.mcgill.ca/gault
KEY PERSONNEL (all emails in format first.lastname@mcgill.ca):
Prof. Martin J. Lechowicz, Director
David Maneli, Coordinator(Academic support & Conservation);
Martin Duval, Coordinator(Security & Services)
Theresa Liberta, Administrative Officer;
Marc-Andre Langlois, Resident Property Manager

RESEARCH FOCUS:A provincially protected 10 km2 reserve located on Mont St. Hilaire, one of ten Monteregian Hills in the St. Lawrence River valley; old-growth northern hardwood forest on rugged terrain comprising the complete watershed of Lac Hertel, a shallow, mesotrophic lake. More than 650 publications on the biology, geography, geology, and meteorology of this area; current studies on hydrology, nitrogen saturation, population ecology of forest herbs, comparative ecology of hardwood trees, invasive species, conservation and diversity of herbs, animal behavior, ecosystem services, forest corridors, land use change etc. Major research program relating environmental heterogeneity to biodiversity at different spatiotemporal scales. Mont St. Hilaire area is designated a Biosphere Reserve by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and is used in long-term ecological research and monitoring that compares undisturbed landscape with developed areas of the same biome type. Research within the MSH-BR is supported by strong community partnerships. The reserve is also a federal migratory bird sanctuary.

RESOURCES: Facilities for scientific workshops and conferences, including accommodations; network of 100 dispersed stations monitoring microclimatic conditions throughout the reserve; over 250 permanent forest inventory plots; and permanent monitoring of aquatic invertebrates and associated water chemistry. Strong GIS database including a high resolution digital elevation model of the reserve based on LIDAR data, much georeferenced metadata on past research.*More detailed information is available on a separate page in this wiki.*

Wilder and Helen Penfield Nature Reserve

The **Wilder and Helen Penfield Nature Reserve** is located on Lake Memphrémagog, 100 km southeast of Montreal, and straddling the US-Canadian border. The station offers laboratories equipped for limnological analyses. The building includes a wet lab, indoor accommodation for up to 8 researchers, a kitchen, and domestic facilities. It stands about 50m from the shoreline, where there is a dock and boat anchorage. As well as shoreline, the land attached to the station includes about a square kilometre of secondary forest. Streams, rivers and more than 30 nearby lakes and ponds offer a wide range of study sites. The station is open from May to October. The station is administered as a satellite of the Gault Nature Reserve.

McGill Arctic Research Station (MARS)

The **McGill Arctic Research Station (MARS)** is located 8 km inland at Expedition Fjord, Nunavut, on Central Axel Heiberg Island in the Canadian High Arctic (approximately 79º26'N, 90º46'W). Established in 1960, MARS is one of the longest-operating seasonal field research facilities in the high Arctic. The station consists of a small research hut, a cook house, and two temporary structures. MARS can comfortably accommodate up to 12 persons. MARS provides access to glacier, ice cap, and polar desert environments. The surroundings are mountainous and glaciated. MARS has the longest continuous mass balance record for any high Arctic glacier (White Glacier). Some of the most detailed environmental information in the Arctic, including topographic map data, have been collected at this station. Current research activities include glaciology, climate change, permafrost hydrology, geology, geomorphology, limnology, planetary analogues, and microbiology. Besides McGill, recent users have included other universities, NASA, the Polar Continental Shelf Project, the Geological Survey of Canada, and the Canadian Museum of Nature.**Contact:** Wayne Pollard, Director. Email: wayne.pollard@mcgill.ca

McGill Sub-Arctic Research Station (MSARS)

The **McGill Sub-Arctic Research Station (MSARS)** is located in Schefferville, Quebec, near the Labrador border. The station offers year-round (summer and winter) access to a vast lichen woodland (containing numerous lakes, ponds, streams, and wetlands), extensive peatlands and alpine tundra in the Labrador Trough as well as access to the adjacent Canadian Shield. MSARS has wet and dry laboratories and a small library. Trucks, snowmobiles, boats, and all-terrain vehicles are available on a rental basis. MSARS can accommodate up to 30 visitors. Room and board is $40 per day for McGill staff and students, $45 per day for individuals from other universities, and $60 per day for all others. Schefferville is serviced by regular air service from Montreal via Sept-Îles or Quebec City (Air Inuit) and by train from Sept-Îles (Tshiuetin Rail Transportation). **Contact:** Wayne Pollard, Director. Email:wayne.pollard@mcgill.ca

Haliburton Forest / Bone Lake Research Station

Location: Haliburton Forest & Wild Life Reserve Ltd., 1095 Redkenn Rd, Haliburton, Ontario K0M 1S0, 10 km north of West Guilford, ON (approx. 48°30' N, 79°22' W)

Research Station Director: Dr. John Caspersen, University of Toronto

Science Coordinator: Dr. Sean Thomas, University of Toronto

Biome Represented: Great-Lakes St. Lawrence forest region / Mixed coniferous – Northern hardwoods

Contact Information: Sean Thomas, University of Toronto, Faculty of Forestry, University of Toronto, Toronto, ON M5S 2L8

Telephone: 416-978-1044 Fax: 416-978-3834

E-mail: sc.thomas@utoronto.ca
Website: http://www.haliburtonforest.com

Affiliation: Partnership between Haliburton Forest and Wildlife Reserve and University of Toronto, Faculty of Forestry.

Permissions: Research activities must be approved by Haliburton Forest and Wildlife Reserve

Amenities: 35,000 ha of forests, lakes, and wetlands, including managed and protected areas. Commercial & experimental forest harvesting and long-term research; Research station (cap. 20) is seasonally operated and contains a basic field lab, dorms, and shared cooking facilities. Research infrastructure includes meteorological instrument tower, and mobile canopy access lift. Haliburton Forest Base Camp (cap. >has high-speed, wireless internet, snowmobiles, trailers, and a commercial restaurant.

In addition to research activities, there are undergraduate and graduate field courses offered; also interpretive and hiking trails, and a public lecture series.

APPENDIX 2. LIST OF BIOLOGICAL FIELD STATIONS AND RESEARCH CENTRES IN CANADA (WITH WEB LINKS)

Station	Province
Barrier Lake Station	AB
Beaverlodge Research Farm	AB
Biogeoscience Institute	AB
Breton Plots, University of Alberta	AB
Cochrane Ecological Institute	AB
Devonian Botanic Garden	AB
Ellerslie Field Station	AB
Emend Project Station	AB
Fort Vermilion Research Farm	AB
George Lake Research Site	AB
Hinton Training Centre	AB
Kinsella Research Station	AB
Lacombe Research Centre	AB
Mattheis Ranch - Rangelands Research Institute	AB
Meanook Biological Research Station	AB
R.B. Miller Station	AB
St. Albert Research Station	AB
Tyrell Museum Field Station	AB
Westcastle Field Station	AB
Bamfield Marine Marine Sciences Centre	BC
Clayoquot Lake Research Station	BC
Deep Bay Field Station	BC
Dr. Max Blouw Quesnel River Research Centre	BC
Laskeek Bay Conservation Society - East Limestone Island	BC
Plant Science Field Station	BC
Salmon Coast Field Station	BC
Tofino Botanical Gardens Field Station	BC

Station	Province
Triangle Island Seabird Research Station	BC
Wells Gray Education and Research Centre	BC
Brandon Research Centre	MB
Broad River Research Cabin	MB
Canadian Rivers Institute Manitoba Field Station	MB
Delta Marsh Field Station	MB
Delta Waterfowl Research Station	MB
Glenlea Research Station/Farm	MB
Nester One Research Station	MB
Owl River Multi-Use Camp	MB
Churchill Northern Studies Centre	MT
Beaubassin Field Station	NB
Bowdoin Scientific Station	NB
Grand Manan Whale and Seabird Research Station	NB
Huntsman Marine Science Centre	NB
Bonne Bay Marine Station	NL
Indian Bay Field Station	NL
Labrador Institute Research Station (Labrador Institute of Memorial University)	NL
Nunatsiavut Government Research Centre	NL
Ocean Sciences Centre	NL
Torngat Base Camp and Research Station	NL
Evelyn and Morrill Richardson Field Station - Bon Portage Island	NS
Harrison Lewis Centre	NS
Mersey Tobeatic Research Institute	NS
Morton Field Station	NS
Nova Scotia Blueberry Institute Field Station	NS
Anderson River Bird Sanctuary Cabin	NT
Canadian High Arctic Research Station	NT
Department of Fisheries and Oceans, Western Arctic Area Office	NT
Devon Island Research Station	NT

Station	Province
South Slave Research Centre	NT
Tundra Ecosystem Research Station, NWT	NT
Western Arctic Research Centre	NT
Western Arctic Research Centre (Inuvik Research Centre)	NT
Alexandra Fjord Seasonal RCMP Outpost	NU
Arviat Research Support Facility	NU
Bylot Island Field Station	NU
Coats Island Camps	NU
East Bay Research Camp	NU
Eureka Weather Station	NU
Igloolik Research Centre	NU
Ittaq Heritage and Research Centre	NU
McGill Arctic Research Station	NU
Nunavut Acrtic College Kivalliq Campus	NU
Nunavut Arctic College (NAC) Kitikmeot Campus	NU
Nunavut Research Institute Iqaluit Research Centre	NU
Lake Hazen	NU
PEARL	NU
Polar Bear Pass National Wildlife Area Research Facility	NU
Polar Continental Shelf Program, Resolute Bay	NU
Quttinirpaaq National Park (Lake Hazen)	NU
Resolute Marine Laboratory, Fisheries and Oceans	NU
Tanquary Fiord	NU
Walker Bay Research Station	NU
Ward Hunt Island Field Station	NU
Alcan Field Station	ON
Environmental Science Western Field Station	ON
Experimental Lakes Area	ON
Great Lakes Forestry Centre	ON
Haliburton Forest / Bone Lake Research Station	ON

Station	Province
Harkness Research Station	ON
Kennedy Field Station	ON
Killarney Research Station	ON
Koffler Scientific Reserve	ON
Long Point Research and Education Centre	ON
Pelee Environmental Research Centre (Proposed)	ON
Queen's University Biological Station	ON
Turkey Lakes Watershed	ON
Wildlife Research Station	ON
Bishop's Biological Field Station	QC
Boniface River Field Station	QC
Centre interuniversitaire de recherche sur le saumon atlantique (CIRSA) Sainte Marguerite	QC
Centre Oceanographique de Rimouski	QC
Clearwater Lake Station	QC
Foret d'Enseignement et de Recherche Simoncouche	QC
Gault Nature Reserve	QC
Lac Duparquet Research and Teaching Forest Research Station	QC
McGill Subarctic Research Station	QC
Nunavik Research Centre	QC
Radisson Ecological Research Station	QC
Saluit Research Station	QC
Station de Biologie des Laurentides	QC
Umiujaq Research Station	QC
Vanier College Field Station	QC
Whapmasgoostui-Kuujuarapik Research Station, QC	QC
Wilder and Helen Penfield Nature Conservancy	QC
Montmorency Forest Reserve	QC
Cypress Hills Field Research and Teaching Centre	SK
Emma Lake Kenderdine Campus	SK
Karrak Lake Research Camp	SK

Station	Province
Matador Field Station	SK
Herschel Island-Qikiqtaruk Territorial Park	YK
Kluane Lake Research Station	YK
Old Crow Arctic Research Facility	YK
Yukon Research Centre	YK