THE UNIVERSITY OF BRITISH COLUMBIA | OKANAGAN

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September 22, 2010

To: **Okanagan Senate**

From: **Learning and Research Committee**

Subject: **Establishment of the Institute for Species at Risk and Habitat Studies (SARAHS) (approval)**

The Learning and Research Committee is pleased to recommend the following to Senate:

Motion: *That the Senate approve the establishment of the* Institute for Species at Risk and Habitat Studies (SARAHS) *as set out in the attached proposal and forward it to the Board of Governors for approval.*

For the Committee
Dr. Peter Arthur
Chair, Learning and Research Committee

THE UNIVERSITY OF BRITISH COLUMBIA

OKANAGAN

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MEMORANDUM

April 20, 2010

TO: UBC Okanagan Senate
Attention: Nathalie Hager Manager, Okanagan Senate Secretariat

FROM: Dr. Alaa Abd-El-Aziz,
Provost and Vice Principal Academic and Research Okanagan

RE: Establishment of the Institute for Species at Risk and Habitat Studies (SARAHS)

RECOMMENDATION:

I recommend that the UBC Okanagan Senate approve the establishment of the Institute for Species at Risk and Habitat Studies (SARAHS) effective July 1, 2010

RATIONALE:

SARAHS has been operating as a centre for the past four years. In late 2009, the process for converting the centre into an institute was initiated. In consultation with my office, a full proposal for the creation of the institute was prepared, along with an executive summary. The executive summary is attached.

The process that was followed complies with the UBC Okanagan Senate Policy on Research Centres and Institutes.

On April 12, 2010, the full proposal was reviewed by the Senate Research and Learning Committee which voted in favour of recommending the creation of the Institute.

I am in support of the creation of this Institute on the terms set out in the proposal and as summarized in the executive summary.

http://www.senate.ubc.ca/okanagan/policies.cfm?go=abstracts

Okanagan Senate

Senate policies

Research Centres

The recommendations in the following report were accepted by the Okanagan Senate at its meeting of February 13, 2008, by the Senate Policies and Procedures Committee.

Characteristics of research centres at UBC Okanagan

A research centre

- Is established or disestablished by a faculty or college dean (or, in the case of multi-faculty centres by the relevant deans serving as a Decanal Steering Committee) in consultation with the Provost and under procedures set by the relevant faculty or faculties.
- Has a project or theme-based mandate that focuses on scholarly or scientific investigation or inquiry; often associated with an internal or external grant.
- Benefits from single or multi-faculty involvement.
- Is led by a director who reports to the host faculty or college dean (or a Decanal Steering Committee for multi-faculty centres) who report(s) in turn to the Provost on matters relating to the centre. A centre is otherwise governed as its host faculty, faculties, or college see fit.
- Adheres to standard university research policies.
- Does **not** offer for-credit programs or courses; centres may offer not-for-credit courses and certificates.

Development, approval, and review of research centres

1. Established through Academic Unit or Department Heads, Deans and/or Directors in consultation with the Provost UBC Okanagan; centres are established within a host faculty, college, or within several host faculties.
2. Upon establishment, a research centre must have a management plan that includes a mandate, sources of funding, and a schedule for review. As a result of such a review, the dean or Decanal Steering Committee may determine that a research centre may continue as a research centre, be considered for transition to a research institute or other type of unit, or be discontinued as appropriate. This management plan and any amendments thereto are to be copied to the Provost of UBC Okanagan.
3. The Provost UBC Okanagan will report for information the establishment of a centre to Senate, but it does not require Senate approval. When a centre is discontinued, the Okanagan Provost will also report that to Senate for information.

Applicability note

The policy is intended to apply to all UBC Okanagan research centres established in the future. Centres that were established prior to the creation of this policy, may wish to consider proposing (and submitting for approval as appropriate) certain adjustments, e.g., to their names, to bring existing units in line with the new policy.

This information is for quick reference. For the full text of the Minutes of Senate, which include the motions and discussion, please see the Minutes Archive.

Okanagan Senate

Senate policies

Research Institutes

The recommendations in the following report were accepted by the Okanagan Senate at its meeting of November 7, 2007, and modified by the Okanagan Senate at its meeting of February 13, 2008, by the Senate Policies and Procedures Committee.

Characteristics of research institutes at UBC Okanagan

A research institute:

- Requires Senate approval to exist.
- Is not normally identified with a single faculty.
- Is intended to be permanent, i.e., intended to exist for more than three years.
- Generally involves external funding as well as the UBC Okanagan base operating budget and is normally allocated a budget.
- Houses paid administrative personnel, including a director.
- Adheres to standard university research policies.
- Is governed through a steering committee which shall include senior administrators as well as faculty and the institute director. There may also be a separate external advisory board.
- Submits annual reports to the Senate on activities. If the institute does not perform to the Senate's expectations three years in succession, Senate may vote to dismantle the institute.
- Does **not** offer undergraduate or graduate programs or degrees; undergraduate and graduate work is the purview of faculties, schools, colleges, and departments.
- May initiate and/or develop undergraduate and graduate courses in partnership with one or more faculties, schools, colleges, or departments. Participating faculty members are appointed to a faculty, rather than to the institute itself.

Development and approval procedure for research institutes

1. Proposal initiated by faculty, Dean, or other university personnel.
2. Preliminary plan submitted to Associate Vice-President, Academic & Research.
3. Associate Vice-President, Academic & Research establishes a committee to develop a full proposal and informs Okanagan Senate Learning & Research Committee.
4. The full proposal, including a business plan, the structure, procedures, plans for a review following a specified period of operation, and an indication that the institute will be fully viable within three to five years, submitted to Senate Learning & Research Committee. The Learning & Research Committee ensures the academic credibility of institutes.
5. Learning & Research Committee reports to Senate with a recommendation.
6. Senate consideration for approval.
7. Senate recommends approval by the Board of Governors.
8. Once approved, the proposal returns to the Associate Vice-President, Academic & Research for implementation oversight.

Applicability note

The policy is intended to apply to all UBC Okanagan research institutes established in future. Institutes that were established prior to the creation of this policy, may wish to consider proposing (and submitting for approval as appropriate) certain adjustments, e.g., to their names, to bring existing units in line with the new policy.

This information is for quick reference. For the full text of the Minutes of Senate, which include the motions and discussion, please see the Minutes Archive.

A PROPOSAL TO THE UBC OKANAGAN SENATE FOR ESTABLISHMENT OF:

THE INSTITUTE FOR SPECIES AT RISK AND HABITAT STUDIES (SARAHS)

EXECUTIVE SUMMARY

Introduction

This proposal outlines a plan for the SARAHS Centre to become an institute. It includes our strategic plan for the Institute, the rationale, a plan for adding to existing partners, a proposed governance and administrative structure, funding, and future needs. In summary, SARAHS is presently fulfilling the role of an institute as defined by the Okanagan Senate. The future ability of SARAHS to grow and serve its partners within and outside the UBC Community will be significantly enhanced if SARAHS is officially recognized as a UBC institute.

History

The Centre for Species at Risk and Habitat Studies (SARAHS) opened in March 2006 at the University of British Columbia Okanagan. The centre's central goal is to enable interdisciplinary research on the structure and function of habitats and populations of species at risk at local, national and international levels. Areas of research focus include globally pressing topics such as: identifying and managing species and habitats at risk, understanding and predicting biotic responses to changing environments, and sustaining resources and ecosystems services in natural and managed landscapes. The breadth of SARAHS membership results in research activities that combine field, laboratory and theoretical approaches to address complex environmental questions. Strategic integration of resources and geographic proximity to the Okanagan Valley, one of the four most endangered eco-regions in Canada, have uniquely situated SARAHS as an emerging leader in conservation science.

SARAHS Centre existing membership and productivity

Since its conception (2006), SARAHS has grown from 20 to 82 members, and its faculty and students currently come from diverse backgrounds across the Faculties of Arts and Sciences and Creative and Critical Studies. As an Institute, we will plan to expand our mission past the Faculties of Creative and Critical Studies and Arts and Science by collaborating with members of other faculties, including The Faculty of Applied Sciences, The Faculty of Health and Social Development and The Faculty of Management.

The productivity of SARAHS has been remarkable; over 90 publications were published by SARAHS Principal Investigators (PIs) 2008/2009 and over 50 media interviews of PIs were performed in the last 4 years.

SARAHS Centre existing space and resources

Thanks to a successful CFI grant in 2004, SARAHS has a number of laboratory facilities equipped with state-of-the-art instrumentation. On the third floor of the Science building, we have a soils lab, microscope room, physiology laboratory, computer/GIS laboratory, ecology laboratory, freezer room, cold rooms, preparatory room, and radio-isotope room. This space has helped to unify the SARAHS research group, and we have used it to accommodate many new faculty members—both members and non-members of SARAHS—while new facilities are being constructed. Although existing infrastructure will continue to support the SARAHS membership, we are approaching a position of needing more space to support our researchers to their full research potential.

SARAHS Centre existing governance and membership

The Dean of the Irving K. Barber School of Arts and Sciences at UBC Okanagan appoints the Director on the recommendation of the voting membership. The Director is responsible for coordinating the operations of SARAHS, including its administrative staff and budget. The Director shall chair the Steering Committee. Founding members have life membership; other interested faculty or people external to the University apply for 3-year terms as members and current members

vote upon their applications. Students of faculty who are SARAHS members are automatically granted memberships; other students may apply. SARAHS has 82 members based on this membership structure.

SARAHS Centre existing administration and staff

The Director, who is advised by the Steering Committee, oversees SARAHS Centre. The Director normally does not have a stipend but does receive a time release from teaching duties. The Steering Committee members contribute their time as part of their service requirement. The SARAHS Centre manages a Fragment Analysis and DNA Sequencing Service (FADSS). It provides DNA preparation, Fragment analysis, and DNA sequencing to SARAHS founding members and to external customers. The Director is responsible for administrating FADSS revenues and expenditures. The SARAHS Director is responsible for hiring and supervising one staff member who manages and runs FADSS as well as assists the director in running SARAHS as a whole. Presently, this staff member is hired full-time as a Research Assistant Tech V. Their annual stipend with benefits is $61,276.32. This is the only position that SARAHS presently supports. In the first 4 years of existence this salary was supported both by FADSS revenue and a CFI Infrastructure Operating Fund (IOF). The IOF expired in March 09, thus the position has been funded solely through FADSS revenue since the expiration date

The New Institute: Its Organization, Governance and Reporting Plan

The Director, appointed by and reporting to the Provost will be a tenured Associate Professor or higher rank who is presently a UBC Okanagan faculty member (Fig. 1). The term of the Director's appointment is normally five years, subject to negotiation between the Provost and the appointee. At least for the next five years, the Director will not have a stipend but will receive a time release from their teaching duties. The Director shall chair the Steering Committee and conduct day-to-day administration. The Institute will have an advisory board in place and will consist of the Director and at least 3 external members. The Provost, on recommendation by SARAHS Steering Committee and Director, will appoint advisory board members.

The Institute for the first 3 years will have two staff members, a Manager and a Technician III. The Director will supervise the Manager who will, in turn, supervise the Technician III. In year 3, an Administrative assistant will be hired, which will be funded by Fee-for-Service revenue. The director of SARAHS will submit an annual report to the Provost. A committee appointed by the Provost after 3 and 5 years following the initial implementation of the Institute will review the Institute.

The New Institute: Its Membership and Affiliated Partners

The membership of SARAHS has quadrupled in the last 4 years. We anticipate that this membership will continue to increase as an institute. As an institute, SARAHS will continue to value partnerships within the University and with government, non-government, community, and international organizations. Partnerships include activities such as joint research, funding agreements, student supervision, dissemination or application of research.

The New Institute: Budget Projection and Business Plan

The budget projection lists the SARAHS budget for this fiscal year and for the following five years (budget projection on file with the Provost). This budget projection is conservative and as an Institute we anticipate much faster growth. As an Institute, we will need our staff to spend more time on securing external partnerships, marketing our services, maintaining the website, raising funds, organizing meetings and workshops and on supervising the technical staff. To accomplish this, we propose to hire a manager to perform these duties. As part of the Institute budget, we are requesting $61,276.32 per annum for the next five years or until additional funds are secured through the methods described below under *A Plan for Fund Raising and Revenue Generation* to fund the manager position. We will continue to hire a technician, but at the level of a Technician III. Thus, the staff of the new SARAHS Institute as compared with the existing Centre will be expanding to allow us to be sustainable within 5 years. The funds to hire a Tech III will be made available from revenue generated from our Fee for Service operation (Fragment Analysis and DNA Sequencing Service, FADSS). Within the first 3 years of

the Institute, we anticipate major growth and we anticipate the need to hire an Administrative Assistant.

The New Institute: A Plan for Fund Raising and Revenue Generation

The major expense for SARAHS will be staff salaries. Revenues from the core facilities will partly cover this expense. Plans to apply for grants and to increase our revenues of the FADSS core facility are in place to cover existing and future hiring's. The success of these plans are not guaranteed, thus we will need to work diligently over the next 5 years with the Development Office and other external organization like FORREX to secure a minimum endowment of at least $1 million to be sustainable without financial support from UBC Okanagan. The intention is to meet once every two months with these organizations until money is secured.

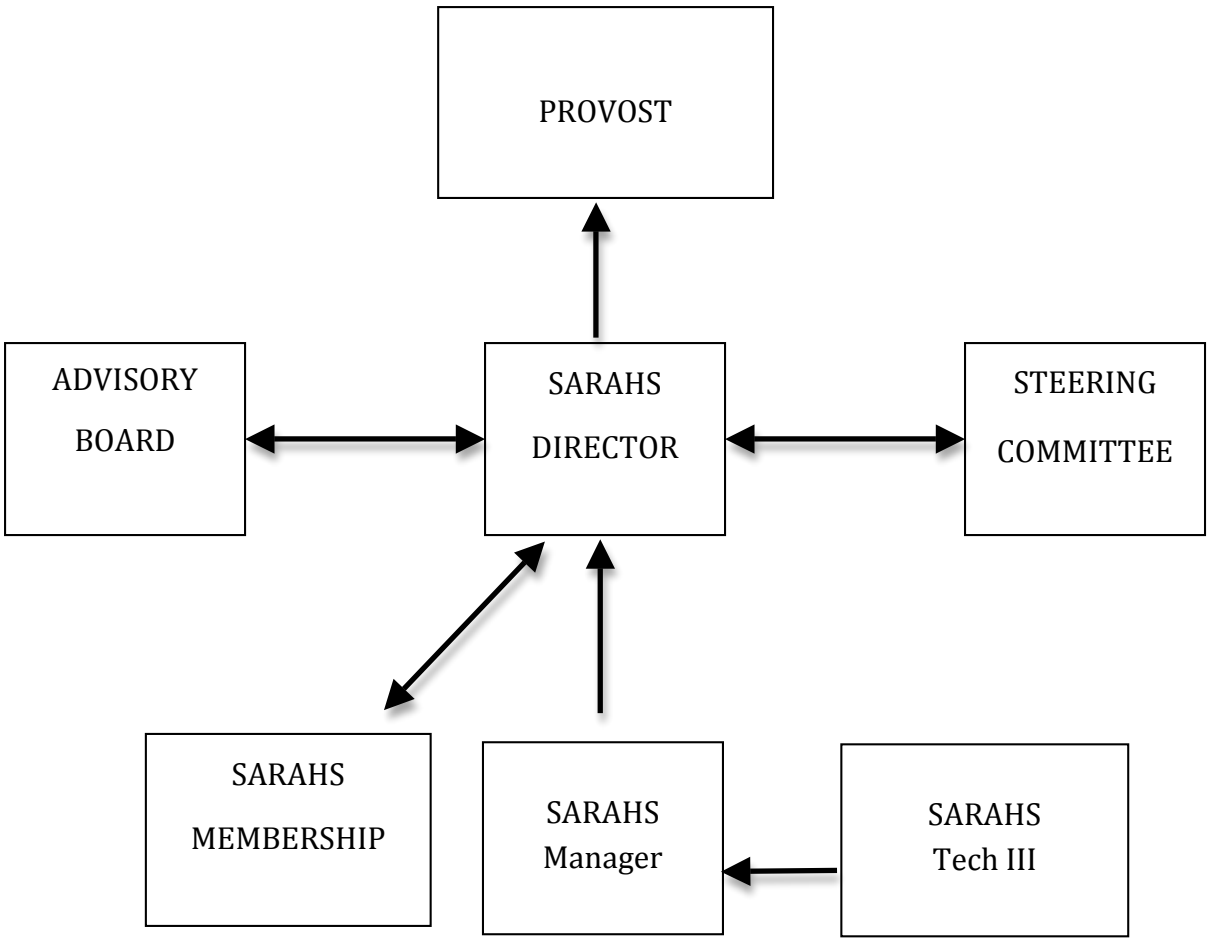

Fig. 1. Administrative levels and reporting

A PROPOSAL TO THE UBC OKANAGAN SENATE FOR ESTABLISHMENT OF:

THE INSTITUTE FOR SPECIES AT RISK AND HABITAT STUDIES (SARAHS)

Submitted

By

Daniel M. Durall
(Current Director of the Centre for SARAHS)

On

25 March 2010

TABLE OF CONTENTS

Vision……3
Mission……3
Strategic Directions……3
Context and Rationale…… 4
Scope……7
Areas of Research Focus……7
Partnerships……12
Dissemination and Application of Results……13
Training……14
Governance, Membership and Reporting……15
Table 1 Membership……16
Figure 1 Administrative Levels and Reporting……17
Funding and Overview of Business Plan……19
Space and Existing Resources……20
Table 2. SARAHS Business Plan……21
Appendix A: SARAHS Publications and Media Activity……27
Appendix B: SARAHS Centre Constitution……37
Appendix C: Shared Vision of SARAHS in 2014……41

VISION STATEMENT

The Institute for Species at Risk and Habitat Studies (SARAHS) is committed to advancing efforts to protect species and ecosystems through interdisciplinary research, training and community engagement.

MISSION

The Institute for SARAHS will be internationally recognized for its interdisciplinary, conservation-oriented research by addressing questions of local and global importance. SARAHS will place The University of British Columbia Okanagan at the forefront of research and management on species and ecosystems at risk. Through the integration of approaches at multiple scales, from the molecule to the ecosystem, SARAHS will become a leading international centre for the training of highly qualified undergraduate, graduate and postgraduate personnel. These researchers will be uniquely positioned to bridge disciplinary barriers to inform and guide effective conservation research and management strategies. In addition to fostering strategic partnerships with First Nations, government, industry, and non-governmental organizations, a defining feature of the SARAHS mandate will be active engagement with community stakeholders including educational outreach and stewardship activities. As an Institute, we will plan to expand our mission past the Faculties of Creative and Critical Studies and Arts and Science by collaborating with members of other faculties, including The Faculty of Applied Sciences, The Faculty of Health and Social Development and The Faculty of Management.

STRATEGIC DIRECTIONS

The strategic directions for SARAHS are:

I. Provide Undergraduate, Graduate and Postdoctoral Training Opportunities

II. Secure Funding for Infrastructure, Training, and Research

III. Add to and build on our existing Partnerships

IV. Translate Research into Action

V. Enhance our Existing Profile and Increase our Visibility

VI. Build Core Teams to address our identified strategic areas

(See Table 2 for detailed business plan associated with strategic directions)

CONTEXT AND RATIONALE

RELEVANCE TO LOCAL, NATIONAL AND INTERNATIONAL NEEDS

Human modification of the environment at a global level, including large-scale habitat conversion and soaring greenhouse gas emissions, exerts significant pressures on ecosystems, threatening the essential goods and services they provide and the substantial biological diversity they harbour. These impacts have been quantified and well-documented:

- Species extinction rates are estimated at 100 to 1000 times background levels

- In 1999, 120% of the Earth's regenerative capacity (foods and goods) was consumed by humans

- Environmental damage caused by the approximately 50,000 alien-invasive species in the United States, coupled with the costs of controlling these species, exceeds $120 billion per year.

- Rapid human-induced global warming is threatening biodiversity as well as human societies

Nationally, Canada's uniqueness in global biodiversity and habitat protection lies in its large land-mass in northern latitudes, containing high proportions of global boreal forest and tundra. As well, it has a high number of species that have their northern range margins within its borders.

At a local level, an estimated 250 species in the Okanagan-Similkameen region of southern BC alone (3% of the provincial area) are of conservation concern, the vast majority of which are so ranked because of their highly restricted distributions within Canada. In addition, the attractiveness of the economy, climate, and lifestyle of the southern interior is causing increasing pressure on the habitats in which these organisms live. Thus, the southern interior of BC provides a living laboratory to address challenges associated with threatened populations and ecosystems and ensuing conflicts with human activities.

In response to these varied threats, SARAHS opened in March 2006 at the University of British Columbia Okanagan to enable interdisciplinary research on the structure and function of habitats and populations of species at risk. SARAHS faculty and students currently come from diverse backgrounds in Biology, Chemistry, Mathematics, Physical Geography, and Earth and Environmental Sciences. Accordingly, SARAHS research activities combine field, laboratory and theoretical approaches to address complex environmental questions. Strategic integration of resources and geographic proximity to the Okanagan Valley, one of the four most endangered eco-regions in Canada, has uniquely situated SARAHS as an emerging leader in conservation science.

COHERENCE WITH UBCO STRATEGIC RESEARCH PLAN

The SARAHS mission and vision are closely aligned with the UBCO Strategic Research Plan (2009-2014). The UBCO Strategic Research Plan emphasizes the importance of interdisciplinarity, partnerships and excellence in research, all demonstrated strengths of SARAHS. “Sustainable Environments and Populations” is noted as one of six Areas of Research Priority, specifically naming SARAHS as an established entity of multidisciplinary strength to lead “research on environmental quality, adaptive responses and sustainable development (to) inform management and policy decisions that contribute to healthy environments for people and other organisms.”

COHERENCE WITH UBCO ACADEMIC PLAN

SARAHS exemplifies two of the imperatives of the UBCO Academic Plan (2005), "An Integrated Research Community" and "A Locally Responsive, Globally Conscious Community," in its composition, scope and vision. SARAHS conducts "a broad spectrum of research (basic-applied, local-global)" (see Research Areas) that benefits from the interdisciplinarity of its faculty and partners; both are Pathways identified in the Academic Plan. A primary aim of SARAHS is to provide "outstanding student experiences and achievements", another Pathway identified in the Academic Plan, through SARAHS seminars, workshops and access to leading-edge infrastructure. Additionally, we are developing a proposal for the SARAHS NSERC Collaborative Research and Training Experience (CREATE) Program designed to broaden perspective from traditional disciplinary-based programs, and provide students with marketable skills, exposure to potential employers, and tangible deliverables in addition to a first-class graduate degree. SARAHS has a proven track record of recruiting international graduate and undergraduate students. Also consistent with the "internationalization" pathway of the Academic Plan, our proposed development of graduate student exchange programs with universities in less-developed countries will further expand the number of international students. Similarly, continued success in recruiting and training high-potential undergraduates has been and will remain a primary focus for SARAHS faculty. These achievements that "integrate teaching and research" have led SARAHS to be featured by UBC international undergraduate student recruiters, establishing important feedback for increasing the diversity and breadth of the Centre's students.

COHERENCE WITH THE UBC ABORIGINAL STRATEGIC PLAN

SARAHS' focus on partnerships and community-based research is in accordance with the UBC Aboriginal Strategic Plan (Draft October 22, 2008), which emphasizes the importance of engaging in collaborative research with Aboriginal communities and finding "ways to support research that respects and benefits Aboriginal communities" (p. 10). From our founding, we have sought relationships with the local communities; the Okanagan Nations Alliance offered a letter of support for our original CFI funding. A number of discussions have already occurred between Centre researchers and members of Aboriginal

communities regarding research collaborations, and we have supported several Aboriginal graduate and undergraduate students. Our strategic plan includes enhancing our training of Aboriginal students, targeting Aboriginal faculty as potential SARAHS members, and continuing to explore more formal partnerships with local Aboriginal communities.

SCOPE

SARAHS focuses on research addressing ways to mitigate the world's biodiversity crisis. The SARAHS mandate is to conduct and disseminate world-class research and training directed towards species considered to be globally at-risk, as well as addressing ways to mitigate fragmented habitats, damaged ecosystem services, and rapidly warming climate.

Specifically, we are committed to:

- conducting cutting-edge research in our identified research themes
- providing world-class training opportunities for graduate students and postdoctoral researchers
- offering substantial opportunities for undergraduate research experience
- fostering an international community of scholars

We strive to work across a range of topics, from specific projects with local relevance to broader theoretical projects with global implications to international projects with colleagues around the globe. Currently, our key research projects fall within the three major themes detailed below

AREAS OF RESEARCH FOCUS

In this section, we outline three major themes of research undertaken by SARAHS researchers—themes that are emergent from the varied interests of our membership, as well as central to global problems of biodiversity conservation. Indeed, SARAHS researchers are engaged in many more projects than the ones highlighted here. We give

just a few subthemes and examples of specific research projects in each major theme, chosen to illustrate the diversity of topics, species, and collaborations occurring within the Sciences and Arts. Almost all of these research projects involve graduate and/or undergraduate students. As we move to an Institute, we will have a greater diversity of research projects encompassing those from not only the Arts and Science and Creative and Critical Studies but from Health, Engineering and Management.

I. IDENTIFYING AND MANAGING SPECIES AND HABITATS AT RISK

(i) Basic biology

Successful conservation of species and habitats at risk requires accurate information about the fundamental biological characteristics of the organisms and ecosystems in question. SARAHS researchers are filling critical knowledge gaps surrounding the basic biology of at-risk species and habitats within the Okanagan and in a variety of settings globally. Specific examples:

- Demography, dispersal, and population genetic structure of Behr's Hairstreak Butterflies, a nationally Threatened species that occupies one of the four most endangered ecosystems in Canada, the antelope-brush shrublands of the south Okanagan. (Lead faculty: Desjardins, Keyghobadi, Pither,).

- Impacts of forest fragmentation (via fires and forestry activities) on the 10-year population cycle of snowshoe hares. Snowshoe hares are a pivotal prey species in most coniferous forests in the US and Canada, and managing for them is integral to protecting the Canada lynx, a federally Threatened species in the US. (Lead faculty: Hodges, Tyson)

- Importance of ectomycorrhizal fungi in the establishment of Douglas-fir seedlings. Large trees form major belowground hubs in a network where younger trees are connected to older trees via root symbiotic (mycorrhizal) fungi, but these networks may be disrupted in the face of forestry activities, water stress, and climate change. (Lead faculty: Durall)

(ii) Conservation Units

Facing the rapid decline of biological diversity, conservation biologists continue to search for methods that can distinguish unambiguous units for conservation purposes. Genetics-based criteria now play a central role in designating such conservation units. Specific examples:

- Identifying cryptic diversity and conservation units in a wide range of at-risk organisms, including Bahamas parrots, Galápagos tortoises, Amur tigers, saltwater crocodiles and Okanagan Lake kokanee. (Lead faculty: Russello).

(iii) Critical habitat

From both ecological and legal standpoints, identifying critical habitat—defined by US and Canadian laws as habitat that need special management as it is essential for survival of the at-risk species—represents a key challenge in conservation efforts. Specific examples:

- Critical habitat designation under the US Endangered Species Act. These projects examine (a) how the law, its policies, biological information, and court cases interacted to affect final determinations, and (b)the mismatch between policy and how criteria are actually used by US government biologists during the designation process. (Lead faculty: Hodges)

- Obtaining habitat information relevant to critical habitat designation. Several SARAHS researchers have data that are being used by government biologists to designate critical habitat, including for Canada lynx in the US and Great Basin gophersnakes, Mormon metalmarks, Great Basin spadefoot, and Behr's Hairstreak butterflies in Canada. (Lead faculty: Desjardins, Hodges, Russello)

(iv) Recovery planning

Species recovery planning and habitat restoration are often essential to ensuring the long-term persistence of at-risk species and ecosystems. Specific examples:

- Identifying characteristics of the Behr's Hairstreak and Mormon Metalmark butterflies' habitat that are essential for maintaining populations of these species. This research

informs decisions a to which sites should be protected and whether the current habitat protection targets are sufficient. (Lead faculty: Desjardins)

II. UNDERSTANDING AND PREDICTING BIOTIC RESPONSES TO CHANGING ENVIRONMENTS

(i) Adaptation

Understanding how natural and human disturbances affect the ecology and physiology of flora and fauna is critical to conservation of species in the face of the current substantial changes in climate and habitats. A number of SARAHS researchers have projects that evaluate adaptive changes of species to changing environmental conditions. Specific examples:

- The genetic basis of adaptation (e.g. thermal tolerance) to climate change of the American Pika. Pikas are potentially threatened by climate-induced changes of their alpine habitats. (Lead faculty: Russello)

-The molecular and physiological basis of adaptations in insects, fish, and amphibians exposed to metals and organic pollutants in the environment. Individually and collectively these research projects provide valuable information for the development of appropriate conservation policy and environmental toxicology guidelines. (Lead faculty:, Mathieson, Reid, Rheault)

(ii) Habitat connectivity and geographic range shifts

Many geographic ranges of organisms are shifting as a consequence of environmental change, especially global warming. Some species, such as many butterflies, are proving adept at taking advantage of new habitats, while others, such as the polar bear, appear to be seriously threatened by climate-induced changes in their environment. Human-induced disruptions in habitats, as well as natural barriers, may prevent some species from shifting ranges. To protect species from climate-induced extinctions, it is important to be able to forecast which species are most at-risk, develop mitigation strategies, and enable movements to new habitats.

- Mountain pine beetles and other forest pests are currently undergoing outbreaks that are partially attributable to climate change. Understanding their movement patterns across fragmented forest landscapes is key to mitigating their damage to forests. (Lead faculty:, Desjardins, Lalonde, Tyson)

- Understanding previous climate changes helps explain current patterns of diversity. Remains of larval chironomids provide useful chronosequences of climate information from previous millennia that can be used to elucidate and anticipate biotic responses to current climate shifts. (Lead faculty: Walker)

(iii) Community shifts

Changes in the environment often lead to shifts in the ecological communities, including local extinctions of some species and introductions of others. These changes can have important consequences to humans and other organisms, so it is imperative we advance our knowledge of how communities form and change in response to various perturbations.

- Pollinator services in the Okanagan. Habitat change and disease are affecting the numbers and kinds of insect pollinators of both native and agricultural plants. Research efforts aim to quantify the value of wild bee populations, their distribution on the landscape and the amount of native habitat that is necessary to sustain them (Lead faculty: Pither)

- Insect biocontrol of invasive plants. Current work on invasive houndstongue, a weevil control agent, and two native flowering species will elucidate whether the introduced weevil is a threat to native species. (Lead faculty: Lalonde, Pither)

- Recolonization of soil fungal communities after forest harvest. Soil fungi, including both saprotrophic and mycorrhizal fungi are essential for nutrient acquisition by plants. Knowing how fungal communities shift following harvest and what fungal community supports seedling growth and development will allow for improved management of forested land. (Lead faculty: Durall, Hart, Jones, Klironomos,)

Human societies would not exist without the numerous resources and beneficial services provided to them by healthy ecosystems. Yet human activities are increasingly compromising the ability of ecosystems to provision these resources and services in a sustained way. To successfully maintain the long-term health of ecosystems, practitioners require more and better information about (i) the quality and quantity of services provided to humanity by ecosystems, (ii) the current and future threats to ecosystems and the services they provide, and (iii) "best practice" methods for sustaining ecosystem health.

- Quantifying pollinator services to Okanagan tree fruits and threats to native pollinators. (Lead faculty: Lalonde, Pither, Tyson, Janmaat)

- Identifying the impact of different forestry practices on the nutrient cycling processes performed by soil fungal communities that are essential to seedling growth within managed forests. This knowledge will allow forest managers to select the most appropriate management protocols to achieve a sustainable forest. (Lead faculty: Durall, Jones)

- Identifying the best practices for minimizing the negative impacts of logging within headwater regions on downstream water quality and quantity (Lead faculty: Wei)

PARTNERSHIPS

SARAHS values partnerships within the University and with government, non-government, community, and international organizations. Partnerships include activities such as joint research, funding agreements, student supervision, dissemination or application of research.

Below, we show a few of the groups with whom we have established links:

Within The University of British Columbia

Okanagan Sustainability Institute (Okanagan)

Watershed Science Research Group (Okanagan)

Beatty Biodiversity Research Centre (Vancouver)

Centre for Applied Conservation Biology (Vancouver)

With governmental agencies:

CANADA

Environment Canada

Canadian Wildlife Service

Parks Canada

Agriculture Canada

BC Ministry of Environment

BC Ministry of Forests & Range

Canadian Food Inspection Agency

Department of Defense

City of Armstrong

Natural Resources Canada

INTERNATIONAL

US National Park Service

US National Forest Service

Montana Fish, Wildlife and Parks

US Department of Agriculture

L' institut nat. de la richerche. agronom. (France)

With non-governmental entities:

Island Conservation

South Okanagan Similkameen Conservation Program

Wildlife Conservation Society

American Museum of Natural History

Okanagan Basin Water Board

Nature Trust of BC

Get to Know

FORREX

With industrial partners:

Tolko

Tree Fruit Growers Association

Dobson Engineering Ltd.

Ecoscape Environmental Consultants Ltd.

DISSEMINATION AND APPLICATION OF RESULTS

The research carried out under SARAHS is directly applicable to many current problems facing societies around the world. Part of our mandate is to disseminate our results to governments, community groups, and other stakeholders. Although this mission is fulfilled in numerous ways, several specific examples already undertaken by our members are:

- Membership on national and international committees, e.g. Recovery Teams for species at risk in Canada, subcommittees of the Committee on the Status of Endangered Wildlife in Canada.
- Engagement with the South Okanagan Similkameen Conservation Program.
- Talks, brochures, and displays through venues such as The Desert Centre (Osoyoos), the Vernon Natural History Museum and through organizations such as FORREX and the Southern Interior Silviculture Committee
- Consulting with US and Canadian government personnel (e.g. US National Park Service, US Fish and Wildlife Service, Canadian Wildlife Service) on management of species at risk.
- Published research in peer-reviewed scientific publications, including international journals and book chapters.

TRAINING

One of our fundamental missions is to provide exceptional training for undergraduate and graduate students, as well as postdoctoral scholars. This training usually consists of informal sessions between faculty or FADSS staff and the student or Post-doc. These do not impinge on formal training as outlined by the mandate of faculties and their units. The majority of our undergraduate participants are likely to come from Ecology and Evolutionary Biology, Zoology, Biology, Earth and Environmental Sciences, Microbiology and Mathematics. Graduate student participants will be primarily enrolled in Biology, Environmental Sciences, Mathematical Biology, and Interdisciplinary Graduate Studies. Undergraduate and graduate students in other programs are also welcome.

Hallmarks that our training mission is thriving include: a diverse international community of students; students that publish, present, and disseminate their thesis research nationally

and internationally; students that win awards and grants (e.g. prizes for best paper or presentation, success with NSERC and other fellowship or grant competitions); international recognition of our training programs; successful career placement of our graduates.

GOVERNANCE, MEMBERSHIP AND REPORTING

The SARAHS constitution (Appendix B) outlines our present structure as a centre. This basic governance structure will remain as an institute, but the staff, membership and administrative duties will expand. This expansion includes reporting (see Fig. 1) and review responsibilties as well as an addition of an Advisory Board. Briefly, the SARAHS Steering Committee advises a Director, who normally has a five-year term. Founding members have life membership; other interested faculty or people external to the University apply for 3-year terms as members and current members vote upon their applications. Students of faculty who are SARAHS members are automatically granted memberships; other students may apply. SARAHS has 82 members based on this membership structure (Table 1).

Table 1. Present members of SARAHS

Principal Investigator	Faculty	Department/ Unit	Undergraduate Students	Graduate Students	Post-Doctoral Fellows	Total Personnel
Sylvie Desjardins	A&S	M&S	1	1	0	2
Daniel Durall	A&S	BPG	1	3	0.5	4.5
Miranda Hart	A&S	BPG	0	0.5	1	1.5
Karen Hodges	A&S	BPG	2	3	0	5
Nancy Holmes	CS	CW				
John Janmaat	A&S	Economics	1	2	0	3
Melanie Jones	A&S	BPG	1	3	1.5	5.5
Nusha Keyghobadi (UWO)	Science	BPG	N/A	N/A	N/A	N/A
John Klironomos	A&S	BPG	0	0.5	2	2
Robert Lalonde	A&S	BPG	2	2.5	0	4.5
Karl Larsen (TRU)	Science	BPG	N/A	N/A	N/A	N/A
Bruce Mathieson	A&S	BPG	1	0	0	1
Susan Murch	A&S	Chemistry	0	2	0	2
Michael Pidwirny	A&S	BPG				
Jason Pither	A&S	BPG	1	3	0	4
Scott Reid	A&S	BPG				
Mark Rheault	A&S	BPG	2.5	2.5	0	5
Michael Russello	A&S	BPG	4	3	1	8
Rebecca Tyson	A&S	M&S	2.0	1.5	0	3.5
Ian Walker	A&S	BPG, EESC	2	1	0	3
Adam Wei	A&S	EESC	0	5	1	6
Total with PIs						**82**

A&S: Arts & Science; CS: Creative Studies; UWO: University of Western Ontario; TRU: Thompson Rivers university; N/A: students are not at UBCO and are not included in the

total; BPG: Biology and Physical Geography; M&S: Mathematics & Statistics; EESC: Earth and Environmental Sciences.

An internal committee appointed by the Provost after 3 and 5 years following the initial implementation of the Institute will review the Institute. As discussed below, the Director will submit an annual review to the provost. The external advisory board will consist of the Director and at least 3 external members, which will be selected externally to UBC Okanagan. The Provost on recommendation by SARAHS Steering Committee and the Director will appoint board members. The appointments will occur during the second year as an institute. The administrative levels and the reporting of the new SARAHS Institute are shown in Fig. 1.

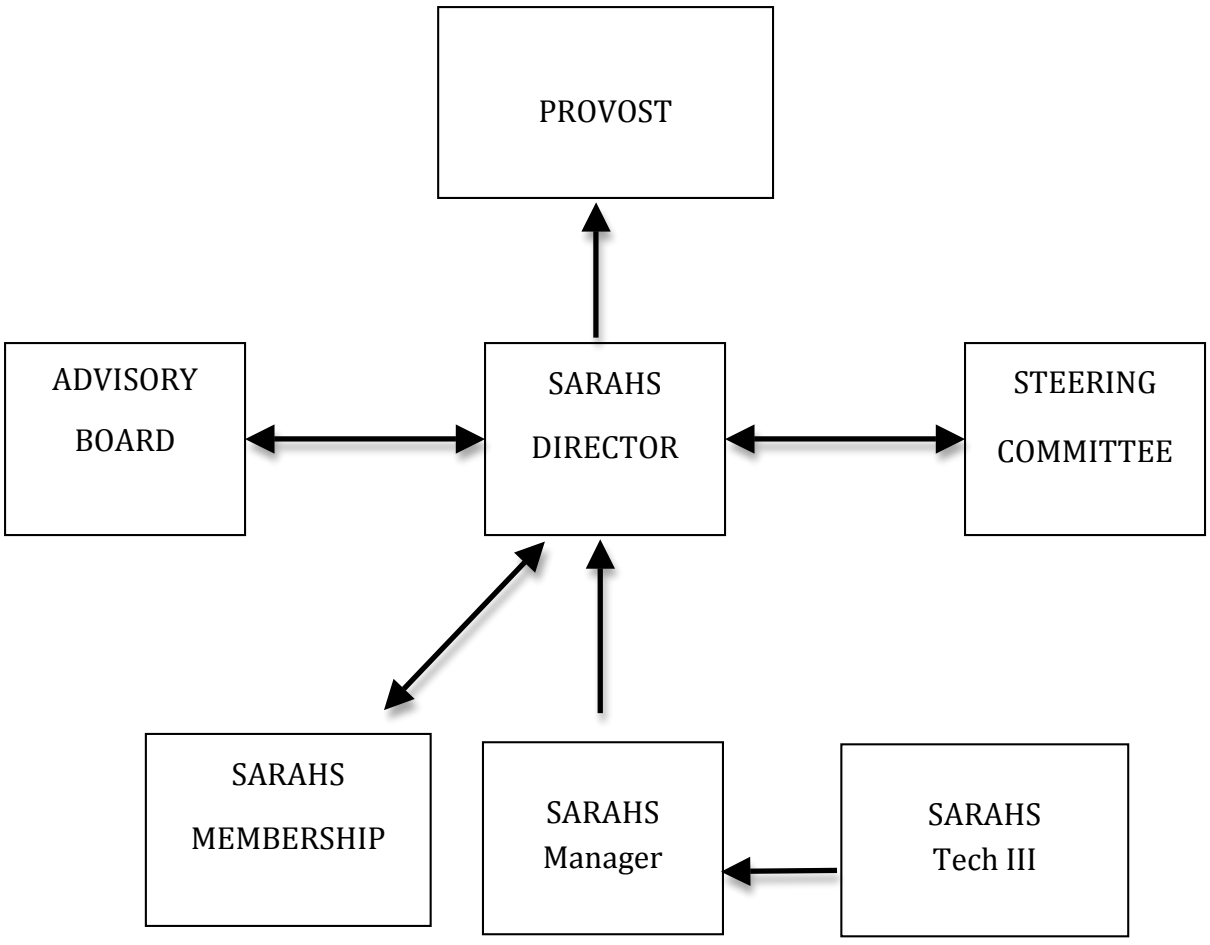

Fig. 1. Administrative levels and reporting

Staffing of the New Institute

The Director, appointed by and reporting to the Provost, will be a tenured Associate Professor or higher rank. The responsibilities include: day-to-day administration of the Institute, including budgetary matters, supervision of Institute staff, oversight of Institute resources and infrastructure, liaison and collaboration with, members, and affiliated partners, facilitating programs and functions to support research activities and research training, publicizing activities of the Institute to internal and external communities, supporting and coordinating research activities of principal investigators and producing an annual report. The provost will appoint this position during the second year of the institute.

SARAHS Manager will manage SARAHS Labs and the FADSS Fee-for-Service operation as well as help in marketing SARAHS products, design and maintain the web site, increase collaborations with industry and external partners, help organize conferences, workshops and retreats, help in the writing of external grants such as the NSERC CREATE or the CFI Leading Edge Fund and work with the Development Office to secure external funding. SARAHS manager will report directly to the director of SARAHS. They will be 1.0 FTE.

The Lab Technician III will report directly to the SARAHS manager. They will process DNA samples for members and external users, maintain equipment, providing a safe and efficient working lab environment. The Lab Tech III will be 1.0 FTE.

An Administrative Assistant will be required after the third year of operation as an Institute. They will provide administrative and financial support to the Institute Director (including monitoring of financial resources), and assist with member communications, promotion of SARAHS including assisting with web site maintenance. They will also assist with communication with industry and external partners.

FUNDING and OVERVIEW OF BUSINESS PLAN

As part of our business plan (shown in Table 2) we will hire a full-time SARAHS manager to help in hosting conferences and workshops, to improve ties with partners, to expand our web site presence, to supervise employees, to help when needed with the fee for service and to continue marketing SARAHS products (see Appendix A) . A major source of revenue for SARAHS is through FADSS, a fee for service operation, which provides DNA sequencing services to SARAHS members, the UBC Okanagan community, and external customers (see attached budget). One full-time technician presently operates it. For the last five years, in addition to the previously mentioned revenue, a CFI Infrastructure Operating Fund (IOF) has supported the operation of SARAHS. This fund has been spent and SARAHS is presently being supported by revenue generated from FADDS, but unfortunately this revenue at this time will not sustain SARAHS. To hire the new manager we will require a subsidy of $61,276.32 from the University until external funding is secured. We will hire a Technician III with the revenue generated from the fee for service. The manager will supervise the Tech III. In collaboration with the UBC Okanagan Development Office and other external agencies (e.g., FORREX), we are actively pursuing financial support for our strategic plan through a possible endowment and by applying for a CFI Leading Edge Fund (LEF) in next December's CFI competition. We also applying for the NSERC CREATE fund. The intention of the business plan outlined in Table 2 is to hire the staff necessary to put in place a revenue generation process and to continue to generate revenue, allowing the Institute to be sustainable within a five-year period.

The majority of SARAHS researchers hold major external funding awards, including NSERC, BC Forest Sciences Program, NSF, and the US Department of Agriculture. A number of SARAHS PIs also hold contracts with government or other agencies. Several of our graduate students hold NSERC awards or Pacific Leader awards, as well as University Graduate Fellowships. SARAHS researchers have already received collaborative grants, and have applied for training programs. In the future, we anticipate that the SARAHS platform will increasingly facilitate these collaborative funding applications.

SPACE AND EXISTING RESOURCES

Thanks to a successful CFI grant in 2004, SARAHS has a number of laboratory facilities equipped with state-of-the-art instrumentation. On the third floor of the Science building, we have a soils lab, microscope room, physiology laboratory, computer/GIS laboratory, ecology laboratory, freezer room, cold rooms, preparatory room, and radio-isotope room. This space has helped to unify the SARAHS research group, and we have used it to enable many new faculty members—both members and non-members of SARAHS—while new facilities are being constructed. Although existing infrastructure will continue to support the SARAHS membership, we are approaching a position of needing more space to support our researchers to their full research potential.

Major space needs for the future include office space for graduate students, postdoctoral fellows, and visiting students or scholars, as well as space for staff. We also hold a regular seminar series and discussion groups, and will continue to need regular meeting spaces (classrooms, conference rooms) for this exchange of ideas.

Our primary resource, however, is our people. We have a diverse community of committed scholars who regularly work together on projects of global importance. In addition, we employ a Lab Tech V who is a unifying element of the SARAHS team and the position provides a resource of information, particularly in the molecular biology field, for undergraduates, graduate students, and faculty. SARAHS is a group of people and a place, together they create an environment for research, teaching and exchange of ideas. As a collective body, we are firmly committed to supporting SARAHS as an institute in which a diverse, international, and multi-disciplinary group of people can work together creatively and productively on widely varied projects.

TABLE 2. SARAHS Business Plan

STRATEGIC DIRECTION I: BUILDING CORE TEAMS TO ADDRESS IDENTIFIED STRATEGIC AREAS

Objective	Strategy	Performance Measures	Targets
SARAHS attracts and retains high quality researchers, community partners, and students to develop core research teams relevant to identified Strategic Areas	Recruit/invite high quality researchers, community partners/students Establish research priority themes as a focus Create incentives and seed funding to support development of research partnerships and pilot studies in indentified research areas Secure Infrastructure, research and training grants (NSERC, CFI, SSHRC, NSF, NIH, USDA, DOD, USGS, EPA, PICS) Build research capacity to facilitate community level research participation (research workshops, training opportunities, habitat and species survey) Establish SARAHS Coordinator position to facilitate the development of mechanisms for the continued growth of interdisciplinary research teams and community partners. Manage core facilities and resources. Establish an Administrative Assistant position to provide administrative and financial support to the director and assist with member communications.	Attraction and retention of researchers and community partners Relative distribution of affiliated researchers/students/grants and publications in strategic research areas New research initiatives/funds for: 1. Research programs in strategic areas 2. Student training 3. Pilot projects 4. Community outreach Involvement of community partners/organizations involved in university-led research initiatives. Number of research teams supported by infrastructure grants in strategic research areas	**Year 1** • ↑ to 28 active PI members • 3 affiliated research projects established in identified strategic areas • 1 formalized community partnership with SARAHS • Hire 1.0 FTE SARAHS manager • Hire 1.0 FTE technician III • Provost will appoint director **Year 2** • ↑ in membership to 100 members • 2-3 new affiliated research applications led by SARAHS researchers • **Year 3** • ↑ in membership to 110 members • 2-3 new affiliated research applications led by SARAHS researchers • Hire 1.0 FTE Administrative Assistant position **Years 4 &5** • ↑ in membership to 120 members • 2-3 new affiliated research applications led by SARAHS researchers • Hire 1.0 FTE SARAHS

			Coordinator position

STRATEGIC DIRECTION II: PROVIDING UNDERGRADUATE, GRADUATE, AND POSTDOCTORAL RESEARCH TRAINING OPPORTUNITIES

Objective	**Strategy**	**Performance Measures**	**Targets**
SARAHS facilitates undergraduate and graduate research opportunities through student mentorship and training opportunities	Recruit high quality students Obtain funding for research internships, training awards (undergraduate, graduate, and postdoctoral fellowships) Apply for NSERC Collaborative Research and Training Experience Program (CREATE) to support undergraduate/graduate students and postdoctoral fellows Design and conduct Seminars and Workshops	Number of SARAHS Student Memberships Number of SARAHS affiliated students obtaining training awards in identified strategic areas Number of seminars/workshops and other training conducted Success in obtaining a CREATE grant.	**Year1** • ↑ in student members • NSERC CREATE submission • SARAHS luncheon seminar series • 2 additional seminar/training workshops conducted **Year 2** • ↑ in student and postdoctoral membership to 20-25 members • ↑ student/training awards • SARAHS luncheon seminar series • 2 additional seminar/training workshops conducted **Year 3, 4 and 5** • ↑ student/training awards • SARAHS luncheon seminar series • 2 additional seminar/training workshops conducted

STRATEGIC DIRECTION III: SECURING FUNDING FOR INFRASTRUCTURE AND RESEARCH

Objective	Strategy	Performance Measures	Targets
SARAHS is supported by basic operating funds from UBCO and secures additional funds from external sources for research and other needs to enable it to function as an innovative world class research organization	Annual funding provided from the Provost's office to support basic operational needs Apply for team grants to support the strategic research areas identified SARAHS Coordinator will assist with securing funding for infrastructure and research Meet with government representatives (e.g. B.C. Ministry of Environment) and major NGOs (e.g. Island Conservation) regarding funding support for research activities and people Maintain connections with UBCO Development Office to present interested donors with options for supporting SARAH's research and infrastructure needs Build connections with external organizations and university organizations to promote resource sharing Apply to funding opportunities such as the Canadian Foundation for Innovation and Western Economic Diversification Programs to expand and update research and training infrastructure Develop community support through organized fundraisers and web site donations.	Resources for basic operating costs received from Provost's Office Number of grants awarded to SARAHS affiliated members in identified strategic research areas Number of Infrastructure grants submitted by SARAHS Number of meetings held with government and NGO representatives Support received from external funding ($ value) Securing a significant single benefactor donation for the support of SARAHS. Number of partnership agreements/MOUs signed with external organizations that include resource sharing	**Year 1** • New CFI Leading Edge Fund grant submission to build on previous CFI Infrastructure grants • 5-10 new affiliated research applications led by SARAHS researchers **Year 2** • 5-10 new research applications led by SARAHS researchers **Year 3** • 5-10 new research applications led by SARAHS researchers **Year 4** • 5-10 new research applications led by SARAHS researchers **Year 5** • 5-10 new research applications led by SARAHS researchers

STRATEGIC DIRECTION IV: DEVELOPING PARTNERSHIPS

Objective	**Strategy**	**Performance Measures**	**Targets**
SARAHS develops a broad spectrum of partnerships and engages with them in collaborative research and information dissemination	SARAHS Coordinator will foster liaison with service settings (FADSS, universities, and NGOs) Explore local, national, and international responses and needs in the identified strategic research areas Identify strategic partners and stakeholders (related to identified strategic areas) Revise current membership process to include additional forms of partners and stakeholders. Develop an MOU template and process; (for data sharing, etc.) for use with partners Present workshop in collaboration with FORREX on Species at Risk for local partners and First Nations Present international conference on Species at Risk as affected by Climate Change	SARAHS Coordinator in place to facilitate development of partnerships and engage stakeholders Number of formalized partnerships/MOUs in place Number of external members from a variety of membership categories	**Year 1** • 1 or 2 signed MOU/partnerships • 25-30 members **Year 2** • 1 or 2 additional MOU/partnerships • 10 new members **Year 3** • 1 or 2 additional MOU/partnerships • 10 new members **Year 4** • 1 additional MOU/partnership • 5-10 new members **Year 5** • 1 additional MOU/partnership • 5-10 new members

STRATEGIC DIRECTION V: TRANSLATING RESEARCH INTO ACTION

Objective	Strategy	Performance Measures	Targets
SARAHS is recognized as a leader in communication of information regarding Species at Risk and Habitat Studies	SARAHS Coordinator will facilitate communication between research projects and support the dissemination of research material and information to the public. Create forums for the exchange of knowledge with policy makers, all levels of government, and the community. Convene annual conference to highlight the research and training activities of SARAHS	SARAHS Coordinator hired to facilitate dissemination of research activities, organize newsletters, websites, public relations, etc Number of forums and events organized by SARAHS Sponsored research symposium at international meeting Annual SARAHS conference held	**Year 1** • ↑in press releases regarding SARAHS **Year 2** • FT SARAHS Coordinator • Biannual electronic newsletter emailed to all members • ↑in press releases regarding SARAHS activities • Symposium related to SARAHS research held at national or international conference **Year 3** • Quarterly electronic newsletter emailed to all members • Initial annual SARAHS conference held at UBCO • ↑in press releases regarding SARAHS activities **Years 4 and 5** • Quarterly electronic newsletter emailed to all members • Annual SARAHS conference held at UBCO • ↑in press releases regarding SARAHS activities

STRATEGIC DIRECTION VI: ENHANCING OUR EXISTING PROFILE AND INCREASING OUR VISIBILITY

Objective	**Strategy**	**Performance Measures**	**Targets**
SARAHS is recognized as an international leader in identified strategic research areas and facilitates interdisciplinary research and public interaction	Design Logo and branding Design and develop website Develop a communications strategy and plan Host annual open houses Create an on campus office/space for SARAHS to connect with partners.	SARAHS Coordinator position established Communication infrastructure developed for the website, e-newsletter, Annual Report Communications strategy and plan in place Number of annual open houses held ↑ SARAHS' profile in the university community and the community outside the university	**Year 1** • Logo designed • website developed • Campus partner office space delineated • Annual report completed • Initial communication plan developed • Initial open house held **Year 2** • Updates to website • Second annual open house held • Conference symposium organized **Year 3** • Updates to website • Third Annual open house held • Initial annual SARAHS conference held at UBCO **Year 4** • Updates to website • Fourth Annual open house held • Annual SARAHS conference held at UBCO **Year 5** • Updates to website • Fifth Annual open house held • Annual SARAHS conference held at UBCO

APPENDIX A. SARAHS PUBLICATIONS AND MEDIA PRESENTATIONS

SARAHS Publications in 2008/2009 (SARAHS PIs in Bold)

1. Antunes PM, Koch AM, Dunfield KE, **Hart MM**, **Klironomos JN**. 2008. Community responses of native arbuscular mycorrhizal (AM) fungi to the introduction of foreign AM fungal inoculum. Plant and soil 317: 257-266.
2. Antunes P, **Klironomos J**, Miller J, Carvalho L, and Newman, J (2008) Even after death the endophytic fungus of *Schedonorus phoenix* reduces the arbuscular mycorrhizas of other plants. Functional Ecology 22, 912-918.
3. Banack SA, Cox PA, and **SJ. Murch** (2008) Flying Fox Consumption and Human Neurodegenerative Disease in Guam. In: Evolution, Ecology, and Conservation of Island Bats. T. Fleming and P. Racey (Eds)
4. Banack SA, **Murch SJ** (2009) Multiple neurotoxic items in the Chamorro diet link BMAA with ALS/PDC. Amyotrophic Lateral Sclerosis. (in press)
5. Beiler , Kevin J., **Daniel M. Durall**, Suzanne W. Simard, Sheri A. Maxwell and Annette M. Kretzer. 2009. Architecture of the wood-wide web: Rhizopogon spp. genets link multiple Douglas-fir cohorts. New Phytologist. doi: 10.1111/j.1469-8137.2009.03069.x (early online) In Press.
6. Brodersen, K.P., O. Pedersen, **Ian R Walker** and M. T. Jensen. "Respiration of midges (Diptera) in British Columbian lakes: oxy-regulation, temperature and palaeo-indicators". Freshwater Biology. 53 (2008): 593 - 602.
7. Callaway RM, Cipollini D, Barto K, Thelen GC, Hallett SG, Prati D, Stinson K, and **Klironomos J** (2008) Novel weapons: invasive plant suppresses fungal mutualists in America but not in its native Europe. Ecology 89, 1043-1055.
8. Calvo Polanco **M, Jones** MD, Zwiazek JJ 2009. Effects of pH on NaCl resistance of American elm (*Ulmus americana*) seedlings inoculated with *Hebeloma crustuliniforme* and *Laccaria bicolor*. Acta Physiologia Plantarum DOI 10.1007/s11738-008-0260-5
9. Calvo Polanco M, Zwiazek JJ, **Jones MD**, MacKinnon MD. 2008. Responses of mycorrhizal jack pine (*Pinus banksiana*) seedlings to NaCl and boron. Trees – Structure and Function 22: 825-834.
10. Calvo Polanco M, Zwiazek JJ, **Jones MD**, MacKinnon. 2009. Effects of NaCl on responses of ectomycorrhizal black spruce (*Picea mariana*), white spruce (*Picea glauca*) and jack pine (*Pinus banksiana*) to fluoride. Physiologia Plantarum 135: 51-61.
11. Campbell DB, Bulmer CE, Philip LJ, Zwiazek JJ, **Jones MD**. 2008. Incorporation of topsoil and burn-pile debris substantially increases early growth of lodgepole pine on landings. Can. J. For. Res. 38:257-267.
12. Carvalho LM, Antunes PM, Martins-Loução MA, Klironomos JN (XXXX) Disturbance influences the outcome of plant-soil biota interactions in the invasive Acacia longifolia and in native species. Oikos, in press.
13. Chase, M, C Bleskie, **IR Walker**, D Gavin and FS Hu. "Midge-inferred Holocene summer temperatures in Southeastern British Columbia, Canada". Palaeogeography Palaeoclimatology Palaeoecology. 257 (2008): 244 - 259.
14. Chen W. and **X**. **Wei.** 2008. Assessing the Relations between Aquatic Habitat Indicators and Forest Harvesting at Watershed Scale in the Interior of British Columbia. Forest Ecology and Management: 256: 152–160

15. Chen, M.Q., **X. Wei** and T. Liu. 2008. Public participation in land use planning abroad and its implications for China. Land Research and Development, 27(6): 100-104. (in Chinese)
16. Chen, X., X. **Wei**, R. Scherer and D. Hogan. 2008. Effects of large woody debris on surface structure and aquatic habitat in forested streams, Southern Interior British Columbia, Canada. River Research and Applications, 24:862-879.
17. Ciofi, Claudio, Adalgisa Caccone, Luciano Beheregeray, Michel Milinkovitch, **Michael Russello** and Jeffrey Powell. 'Genetics and conservation on islands: the Galápagos giant tortoise as a case study'. Population Genetics For Animal Conservation (2009). Ed. G. Bertorelle, M. Bruford, H. Hauffe, A. Rizzoli, C. Vernesi. Cambridge University Press.
18. Cole IB, Cao J, Alan AR, Saxena PK, **Murch SJ** (2008) Comparisons of Scutellaria baicalensis, Scutellaria lateriflora and Scutellaria racemosa: Genome size, antioxidant potential and phytochemistry. Planta Medica 74:474-481.
19. Cole IB, Farooq FT, and **SJ Murch** (2009) Protocols for Establishment of an In Vitro Collection of Medicinal Plants in the Genus Scutellaria. In: Methods in Molecular Biology. SM Jain and PK Saxena, (eds).
20. Constible, J.M., P.T. Gregory, and **K.W. Larsen**. 2009. The pitfalls of extrapolation in conservation: movements and habitat use of a threatened toad are different in the boreal forest. Animal Conservation early view publication.
21. Cox, P. A., Banack, S. A., and **Murch, S. J.** (2008). Cyanobacteria, Cycads, and Chamorros: A Medical Mystery. In: Proceedings of the Seventh International Conference on Cycads. R. Osborne, A. P. Vovides, and D. S. Stevenson (Eds.). ISBN-13: 9780893274900
22. De Deyn GB, Biere A, van der Putten WH, Wagenaar R, **Klironomos JN** (2009) Chemical defense, mycorrhizal colonization and growth responses in *Plantago lanceolata* L. Oecologia 160, 433-442.
23. Gabora, L., **Holmes, N**. 2008. "Dangling from a Tassel on the Fabric of Socially Constructed Reality: Reflections on the Creative Writing Process." In A. Cropley, D. Cropley, J. Kaufman, & M. Runco (Eds.) The Dark Side of Creativity. Cambridge UK: Cambridge University Press. TBA
24. Gavin, Daniel G., Hu, F. S., **Ian R. Walker** and Karlyn Westover. The northern inland temperate rain forest of British Columbia: Old forests with a young history? Northwest Science 83 (2009): 70-78.
25. Gonçalves da Silva, A., White, K.E., Kirk, S.L., Bishop, C.A., **Hodges, K.E**. and **Russello, M.A.** Isolation and characterization of microsatellite loci in two British Columbia species-at-risk: Great Basin spadefoot (*Spea intermontana*) and Western painted turtle (*Chrysemys picta belli*). Conservation Genetics Resources: in press.
26. Gonçalves da Silva, Anders, Danielle Lalonde, and **Michael Russello**. 'Isolation and characterization of microsatellite loci in a Neotropical ungulate, the lowland tapir (Tapirus terrestris).' Conservation Genetics Resources (2009): in press.
27. Gordon AM, Thevathasan NV, **Klironomos J**, Bradley R, Shipley B, Cogliastro A, Olivier A, and Whalen J (2008) Agroforestry in the world: lessons for Canada. Policy Options 2, 79-82.
28. Goring, Simon J., Marlow G. Pellatt, Terri Lacourse, **Ian R. Walker** and Rolf W. Mathewes "A new methodology for reconstructing climate and vegetation from

modern pollen assemblages: an example from British Columbia". Journal Of Biogeography 36 (2009): 626-638.
29. Gulden RH, Lerat S, Blackshaw RE, Powell JR, Levy-Booth DJ, Dunfield KE, Trevors JT, Pauls KP, **Klironomos JN**, and Swanton CJ (2008) Factors affecting the presence and persistence of plant DNA in the soil environment in corn and soybean rotations. Weed Science 56, 767-774.
30. **Hart MM**, Powell JR, Gulden RH, Dunfield KE, Pauls KP, Swanton CJ, Klironomos JN, Antunes PM, Koch A, Trevors JT. 2009 The effect of glyphosate resistant corn and glyphosate on the numbers and diversity of denitrifying bacteria and soil fungi. Pedobiologia 52: 253-262.
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36. **Hodges, K.E**. 2008 Response to Jax (letter to the editor). Frontiers in Ecology and the Environment. 6:179.
37. **Hodges, K.E.** 2008. Defining the problem: ecological terminology and progress in ecology. Frontiers in Ecology and the Environment 6: 35-42.
38. **Hodges, K.E.** and J. Elder. 2008. Critical habitat designation under the ESA: court-ordered designations use more criteria. Biological Conservation 141: 2662-2668.
39. **Hodges, K.E.** and L.S. Mills. 2008. Designing fecal pellet surveys for snowshoe hares. Forest Ecology and Management 256: 1918-1926.
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46. **Jones MD,** Grenon F, Peat H, Fitzgerald M, Holt L, Philip LJ, Bradley RL. 2009. Differences in ^{15}N uptake amongst seedlings colonized by three pioneer ectomycorrhizal fungi in the field. Fungal Ecology.
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Media Interviews and News Articles between 2006-present

Dan Durall

2006-08 Interviewed by UBCO TV concerning SARAHS research

2006-08 Provided tours of SARAHS labs to UBC Vancouver/Okanagan recruiting officers

2006-08 Provided tours of SARAHS labs to Research Week tours

2006-08 Provided tours of SARAHS labs to Science Fair students

Bob Lalonde

-Interviewed by Mike Roberts for an "Okanagan Now" segment, on Cicadas in the Valley. - Laboratory research group profiled by the Bulletin of the Entomological Society of Canada.

- Articles in UBC reports and local paper on Mountain Pine Beetle project.

- Interviewed by CHBC about Mountain Pine Beetles in the Valley.

Susan Murch

Print media which has interviewed you or written about your work (please note topic)

The New Yorker (2005) 'ALS/PDC in Guam'

The Best Science Writing 2006 'ALS/PDC in Guam'

Honolulu Advertiser 2006, 'Alzheimer's toxin found in common algae type'

Milwaukee Journal Sentinel 2006, 'Brain toxin found in algae in water'

Honolulu Star Bulletin News, 2006, 'Water-scum toxin linked to nerve ailments'

Victoria Times Colonist, 2006, 'Algae toxin linked to Alzheimer's'

Science News, 2006, 'Many cyanobacteria make a neurotoxin'

The Miami Herald, 2006, 'Botanist researching whether toxin could cause neurological diseases'

Medical News Today, 2006, 'Blue-Green Algal Links to Alzheimer's-Like Neurological Disease'

Journal of the American Medical Association, 2006, 'Environmental Neurotoxin May Pose Health Threat'

Scientific American, 2006, 'Algae Found to Produce Potential Neurotoxin'

Chemical & Engineering News, 2006, 'Neurotoxin made by most cyanobacteria'

The Daily Courier, Thursday, July 5th, 2007, 'UBCO gets big research boost'

Capital News, Friday July 6, 2007, 'UBCO gets $800,000 in grants'

Trek, Spring 2007, 'Lonesome Pine'

Science News, November 17, 2007, 'Back from the Dead?"

University Affairs, April 2009, Tapping into breadfruit's bounty

UBC Reports, December 2008, Preserving the bounty of breadfruit

Food Navigator USA, December 2008, Nutrition potential of breadfruit explored

The same article appeared in > 30 newspapers / magazines across North America

Newsweek, August 10, 2009'Breadfruit to the rescue'

HanaHou! August / Sept, 2009, Tree of Plenty: The bounty of breadfruit

Smithsonian, Sept. 2009, Captain Bligh's Cursed Breadfruit

TV and radio programs on which you were interviewed or which highlighted your work (please note topic)

CTV News Net (ALS/PDC in Guam & cyanobacterial blooms in Ontario)

CKCO TV News (Kitchener, Ontario) (Toxins in cyanobacterial blooms)

CBC Toronto (ALS/PDC in Guam)

CBC Kelowna (CRC Chair)

CBC Radio, Tuesday June 5th, 2007, David French (Interviewer), Wollemi Pine.

CHBC News, Opening of the Fipke Centre for Innovative Research (Nov. 2008)
CBC News, Breadfruit & Food Security (Dec, 2008)
CBC Victoria, All Points West, Wollemi Pine and Endangered Plant Species (May 28, 2009)

Michael Russello

Broadcast Interviews

Jul 7, 2009 **Les Annees Lumiere**; CBC Radio; Amur tigers on 'genetic brink'

Sep 27, 2008 **The Sean Leslie Show** ; CKNW News (Vancouver); Rediscovery of extinct species of Galápagos tortoise; Interviewed By: Jill

Bennett (guest host)

Sep 26, 2008 **Evening News** ; CTV News; Rediscovery of extinct species of Galápagos tortoise; Interviewed By: Kent Molgat

Sep 26, 2008 **Morning Edition** ; CBC Radio; Rediscovery of extinct species of Galápagos tortoise; Interviewed By: Marion Barschel

Sep 25, 2008 **The Takeaway** ; WNYC New York Public Radio; Biologists are using DNA to bring an extinct tortoise back from the dead;

Interviewed By: John Hockenberry and Adaora Udoji

Jul 4, 2007 **My Science Project** ; UBC Radio (CiTR); Molecular Scatology; Interviewed By: Julia Boughner

May 15, 2007 **Western Australia's Early Morning Program** ; ABC Radio; Lonesome George ; Interviewed By: Wayne Dowsett

May 5, 2007 **Morning Weekend Edition** ; CBC TV News ; Lonesome George; Interviewed By: Marivel Taruc

Selected Text Interviews

July 8, 2009 **Scientific American** ; Rare Siberian tigers face potential genetic bottleneck; Interviewed By: John Platt

July 2, 2009 **BBC News** ; Amur tigers on 'genetic brink'; Interviewed By: Matt Walker

Mar 5, 2009 **Kelowna Daily Courier** ; SARAHS' strategy to save; Interviewed By: Jody Jacobs

Sep 25, 2007 **Canadian Press** ; B.C. scientist part of global group trying to bring back extinct tortoise species; Interviewed By: Camilla Baines

Sep 21, 2008 **The Province** ; Invaders are among us; Interviewed By: Cheryl Chan

Apr 18, 2008 **National Geographic News** ; Captive Tigers Harbor Rare "Purebred" Genes; Interviewed By: Susan Brown

Sep 5, 2007 **Nature** ; Tigers in trouble: Year of the tiger; Interviewed By: Jerry Guo

May 2, 2007 **Canadian Press** ; Research suggests rarest creature on earth may have relatives; Interviewed By: Elianna Lev

May 2, 2007 **The Province** ; UBC prof says Lonesome George has distant relative ; Interviewed By: Lena Sin

May 1, 2007 **Globe and Mail** ; Will Lonesome George find love with an Isabella belle?; Interviewed By: Anne McIiroy

Apr 30, 2007 **BBC News** ; DNA search gives hope to tortoise; Interviewed By: Paul Rincon

Apr 30, 2007 **New York Times**; A Lonesome Tortoise, and a Search for a Mate ; Interviewed By: John Tierney

Apr 30, 2007 **Cell Press**; Lonesome George is not alone among Galápagos tortoises; Interviewed By: Erin Doonan

Apr 23, 2007 **New Scientist** ; Galápagos tortoises: untangling the evolutionary threads; Interviewed By: Henry Nicholls

Sep 22, 2006 **Kelowna Capital News**; Bolstering the kokanee run a new challenge; Interviewed By: Jennifer Smith

Jul 6, 2006 **UBC Reports**; Exploring ecology at the molecular level; Interviewed By: Bud Mortenson

Dec 18, 2005 **New Haven Register**; Yale scientists recognize new species of tortoise; Interviewed By: Abram Katz

Nov, 2005 **Natural History Magazine**; You can’t tell a tortoise by its cover; Interviewed By: Graciela Flores

Jul 27, 2005 **MSNBC.com**; Darwin's tortoises more diverse than he knew: Scientists have found reptile is not one species but three;

Interviewed By: Robert Britt

APPENDIX B: SARAHS CONSTITUTION (ESTABLISHMENT MARCH 7, 2006)

SARAHS

Species At Risk and Habitat Studies

Irving K. Barber School of Arts and Science. The University of British Columbia Okanagan, Kelowna, BC Canada V1V 1V7

A Proposal To Establish The University of British Columbia Okanagan Centre for Species At Risk and Habitat Studies

Background

This is a proposal for the creation of a Senate-approved, inter-departmental Centre for Species at Risk and Habitat Studies (SARAHS) at the University of British Columbia Okanagan. SARAHS comprises a multidisciplinary group of researchers addressing questions relevant to the structure and function of habitats and populations of species at risk. This research spans multiple levels of organization from the molecular to the landscape. SARAHS researchers address the dynamics of habitats and species across multiple temporal and spatial scales.

Mission

The mission of The SARAHS Centre is to support basic and applied research; to collaborate with and provide relevant information to managers, government, and community organizations; and to train undergraduate and graduate students.

Goals and Objectives

A primary goal of the SARAHS Centre is to gain new knowledge through research on species at risk and on their habitats within which they live. Presently, the Centre consists of 15 UBC Okanagan scientists from a number of departments including Biology, Chemistry, Earth and Environmental Science, Physical Geography, and Mathematics and Statistics. To establish SARAHS within the new third floor of the Science Building, SARAHS was awarded $2.22 million of infrastructure support by CFI, BC Knowledge Development Fund, UBC and various supply vendors. These funds include $1.2M for research laboratory space and $1M for new, multi-user equipment. These funds have allowed us to cluster scientists from six different departments on the third floor of the Science building. This clustering has resulted in a powerful force allowing us to collectively address complex questions concerning the sustainability of species and their habitat.

Collaborations and Partnerships

The interdisciplinary nature of SARAHS allows it to attract a wide diversity of partners, including from collaborators within the University, and from regional, national and international organizations . Presently, we have partnerships with other Universities (Thommpson Rivers University) , provincial (Ministry of Environment), federal government agencies (Parks Canada, Environment Canada), and regional organizations (South Okanagan Similkameen Conservation Program).

Membership, Governance and Administration

SARAHS membership shall consist of the founding members (Dan Durall, Melanie Jones, Nusha Keyghobadi, Karl Larsen, Bruce Mathieson, Scott Reid, Rebecca Tyson, Ian Walker and Karen Hodges) and a body of interested persons from UBC Okanagan and partner organizations. Membership will be divided into two categories:

1) Voting members (founding members and new members added by voting majority).

2) Graduate student members. Graduate students supervised by members of SARAHS are automatically eligible for membership. Graduate students of non-member supervisors may apply for membership.

Terms of membership: founding members are without term. All other voting memberships are by application and approval is by a simple voting majority for a three year renewable term.

Membership of the Steering Committee will be selected by voting members of SARAHS and will consist of the director, three UBC Okanagan faculty members, a representative from a partner organization, and a graduate student representative. Steering committee members from UBC Okanagan will be appointed to three-year renewable terms. The partner organization and graduate student representatives will be appointed to two-year terms. The partner membership on the Steering Committee will rotate between the different partner organizations every two years. At least two different UBC Okanagan academic units should be represented on the Steering Committee. The Steering Committee shall meet at least once a year, making recommendations to the voting membership for approval.

SARAHS is overseen by a Director and a Steering Committee. The Director shall be appointed by the Dean of the Irving K. Barber School of Arts and Sciences at UBC Okanagan on the recommendation of the voting membership. The Director is responsible for coordinating the operations of SARAHS, including its administrative staff and budget. The term of the Director's appointment is normally five years, subject to negotiation between the Dean of the Barber School and the appointee. The Director shall chair the Steering Committee.

There will be at least one annual general meeting open to all members of SARAHS. The voting membership of SARAHS will vote to make changes to the SARAHS Constitution; to approve membership applications; to approve the budget and major expenditures; to decide on membership of the Steering Committee; and to address other matters arising. Changes in constitution require a two-thirds majority vote, whereas other matters require a simple majority. A quorum of 50% of voting members plus one will be necessary for a passing vote.

The SARAHS constitution will be approved by Senate in accordance with the UBC Senate policy abstract on the Status of Institutes and Centres, and shall be administered in accordance with UBC policy #87 on Research and Policy #97 on Conflict of Interest and Conflict of Commitment. If the SARAHS constitution and university policy differ, university policy shall prevail. The SARAHS centre is housed within the Irving K. Barber School of Arts and Sciences at the University of British Columbia Okanagan.

The Centre will manage a Fragment Analysis and DNA Sequencing Service (FADSS). In addition to Fragment analysis and DNA sequencing services, it will provide DNA preparation services to SARAHS founding members and to external customers. The SARAHS Director is responsible for hiring and supervising technical support and for administrating FADSS revenues and expenditures. FADSS will have a pricing scale in place. Pricing will be based on four categories (listed in the order of the degree of discount): 1) SARAHS founding members; 2) UBC Okanagan faculty; 3) non-UBC Okanagan academics (researchers paying for services who are not affiliated with projects/grants of UBC Okanagan faculty); and 4) private sector. Founding members collaborating on projects that are not SARAHS related, and for which they are not Principal Investigators on the grant, will pay the UBC Okanagan rate. Prices are subject to adjustment by the approval of the Steering Committee. Overhead will not be collected from FADSS revenues generated from non-private sector users (SARAHS founding members, UBC Okanagan faculty and non-UBC Okanagan academics): their fees will go towards the FADSS operations, maintenance of equipment, salary for technicians, amortization of equipment (saving money for the eventual replacement or maintenance of equipment). Revenue above these expenditures will be used with the advice of the steering committee and the approval of the voting membership. Twenty-five percent overhead will be charged on all private sector revenue. Based on UBC policy, this overhead will be divided among the University-Industry Liaison Office (UILO), the President's Office, and the Deans Office. SARAHS will negotiate with the Dean to have a portion of the overhead go to funding SARAHS related activities.

Budgetary Implications

SARAHS will be established using no UBC General Purpose Operating Funds. Instead, operating funds will be raised from, personal operating grants, DNA sequencing services and from external donors. These funds will cover the operating expenses. A technician is presently funded by a CFI Infrastructure Operating Fund to maintain operate equipment purchased through CFI and BCKDF funding.

Student Training

SARAHS will establish a unique interdisciplinary training environment that will be critical to understanding species at risk and their habitat. Students and other trainees will be enrolled in established UBC Okanagan Departmental graduate or training programs. However, as an interdisciplinary research centre, SARAHS will enrich these training programs with a truly integrative approach taking advantage of our diversity of knowledge in our faculty and staff and will provide state of the art facilities whereby this collaborative approach will excel.

Summary

The experimental resources provided by SARAHS and its partners, and the increased collaborative interactions that these resources have begun to promote, will lead to a wide variety of solutions to our decline in species and their habitat . The SARAHS Centre will make a valuable and lasting contribution to the research community at UBC Okanagan as an official University Centre.

APPENDIX C: SHARED VISION OF SARAHS IN 2014

- Engage local and regional stakeholders in SARAHS research
- Maintain a strong base of engaged community partners, including those from the Aboriginal community
- Generate national headlines and an international research profile
- Fulfill a research advisory role for guiding policy and decision-making
- Develop and maintain a nationally and internationally recognized student training program for domestic, international and First Nations students
- Host the 2013 conference of the Canadian Society of Ecology and Evolution
- Develop and host workshops/modular courses on a regular basis
- Organize symposia/special issue of a journal
- Support regular visiting scholars (or interdisciplinary groups of scholars that contribute to training program)
- Establish sustained funding streams
- Work to develop a CFI-funded cryofacility and museum for Canadian species at-risk of extinction
- Achieve adequate administrative and technical support
- Acquire additional infrastructure
- Integrate research and teaching (ex. white paper seminars)