A Biodiversity Initiative for the University of Wyoming

Report of the President's Task Force on Biodiversity
July 12, 2011

UNIVERSITY
OF WYOMING

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In January, the University of Wyoming celebrated the dedication of a wonderful new facility, the Berry Biodiversity Conservation Center. This new facility offered an opportunity for UW to develop and integrate excellence in several of our areas of distinction, including life and environmental sciences and natural resources. I challenged a faculty task force to develop a vision and plan for a strong interdisciplinary program in the field of biodiversity science, and they have fulfilled that challenge.

The President's Task Force on Biodiversity has developed a plan for the study of Biodiversity Science at the University of Wyoming that outlines a truly interdisciplinary approach, including both the science of biological diversity and the analysis of the interplay between society and the variety of life in the natural world. As pointed out by the recognized international experts in this field who were consulted by the task force, no university has yet launched such a broadly based, biodiversity-focused program that integrates the biological sciences with physical and social sciences and humanities fields. The University of Wyoming's location in a natural-resource dependent state makes it an appropriate institution to develop solutions to issues in biodiversity science and conservation in partnership with government resource-management agencies and other stakeholders.

The proposals in the Biodiversity Initiative Report are thoughtful, creative and significant. Although too numerous to discuss each in detail, among the highlights are proposals for an undergraduate curriculum in Biodiversity Science; a long-term monitoring network that will provide a set of outdoor laboratories in which to perform research, teaching and outreach; a biennial Biodiversity Summit; and a set of education and outreach activities aimed at training and two-way interactions between UW and land resource professionals.

We have the will and the flexibility at the University of Wyoming to start to implement the Biodiversity Science plan. First we must integrate the initiative into the university planning process, since the university's strategic plan serves as the road map for allocation of major personnel and financial resources. Over the past 13 years, major new initiatives undertaken by UW have profited greatly through inclusion in the University planning process. Our university plans outline major new initiatives and announce them to the campus community and others. The School of Energy Resources, the university computational science initiative, the Program in Ecology, and the fine arts expansion are all examples of resource commitments that grew out of priorities identified through university planning. Provost Myron Allen has agreed to include Biodiversity Science as a major priority as UW begins to shape its next strategic plan in the coming year.

Integrating Biodiversity Science into university planning entails less delay than one might suspect: some ideas proposed for UW's 2009-2014 strategic plan were ready for implementation — including early-stage funding — almost immediately after the Trustees approved the plan. The actual rate at which the

initiative is developed will depend upon whether we rely solely upon reallocation of existing UW resources, or whether these can be augmented by new external resources.

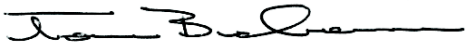
I envision three significant next steps requiring leadership from members of the task force and others in the UW community. First, it is necessary to map out a program of faculty positions that could be requested through our central position management process so that departments interested in participating in the initiative can compete for faculty positions as they are identified. Depending upon other institutional commitments and adequate support from the state's general fund, it is possible that up to two positions per year could be allocated to the Biodiversity Initiative through this process alone. Privately-funded professorships could accelerate new faculty hiring in this area. And any hiring program should take into account the strength that UW has already built in developing cognate programs in ecology, environment and natural resources, and other areas of distinction that can contribute to the Biodiversity Initiative. Many present UW faculty will want to join the initiative.

Second, a committee will need to develop a more specific plan for the proposed undergraduate curriculum in biodiversity science, following the concepts presented in the Biodiversity Task Force Report. To avoid unnecessary growth in faculty workload, the curriculum must build upon the expertise of the faculty and either take advantage of or replace currently existing courses to the maximum extent possible. It also must be well-articulated with the new University Studies Program that will be finalized in the near future.

Third, we must establish leadership for the initiative. It is time to launch a search for a director of the Biodiversity Science program. We will require a person with the vision and energy to move plans to reality. This director will be based in the Berry Center and assume the duties of the director of the Berry Center, currently a volunteer position held by a senior faculty member. In the meantime, the activities of the Biodiversity Science program will be overseen and coordinated by the director of the Berry Center.

In addition, I urge the task force to identify participants to proceed with the planning for the Wyoming Biodiversity Observatory Network, the first Biodiversity Summit, the Wyoming Atlas, and to continue the outreach and education activities already underway at the Berry Biodiversity Conservation Center.

In closing, I congratulate the task force for a job well done, and I look forward to the implementation of their plans and the development of the Biodiversity Science program at the University of Wyoming.



Thomas Buchanan
President

A BIODIVERSITY INITIATIVE FOR THE UNIVERSITY OF WYOMING

REPORT OF THE PRESIDENT'S TASK FORCE ON BIODIVERSITY

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I. EXECUTIVE SUMMARY

The biological diversity of our planet is the result of several billion years of evolution, shaped by natural processes, including recent human activities. Biodiversity has important benefits for human society, providing economic opportunities, maintaining its quality of life, and shaping its moral concerns. Changes in biodiversity can thus have significant consequences for human well-being. Biodiversity is a particularly important concern to Wyoming, with its economy and ways of life that depend on its unique natural setting and ecological diversity.

The University of Wyoming is already nationally and internationally recognized in ecology, environmental sciences, natural resources, and environmental and resource economics for its contributions to biodiversity research. As both a diversified liberal-arts university and land-grant institution, the University has opportunity to contribute to virtually every aspect of biodiversity research and to develop an interdisciplinary curriculum for biodiversity studies. And by virtue of its proximity to a diverse array of pristine, managed, and disturbed ecosystems, the University can utilize a unique set of outdoor laboratories for research, education, and outreach applications.

The University of Wyoming is well-positioned to attain national and even international leadership in research, education, and outreach related to biodiversity, with benefits for the state, the nation, and the world. The University can build on its considerable existing assets, including its faculty, academic programs, and facilities, to reach a new level of integration and distinction. This requires a long-term commitment not only to maintain and enhance these assets but also to invest in new synergistic linkages fostering interdisciplinary biodiversity scholarship and education across the University as well as greater public engagement in these activities. Although the primary geographic focus will be on biodiversity in Wyoming and the Rocky Mountain region, the University could become a new global model for biodiversity science and studies devoted to improved public understanding and management of the world's unique natural heritage.

To achieve these goals, the University proposes to establish a campus-wide Biodiversity Initiative to provide leadership in the interdisciplinary teaching, research and scholarship, and outreach needed to address the central challenges in the field, which are to develop integrated understanding of:

- the dimensions of local, regional, and global biodiversity,
- the physical, biological, and societal processes that govern biodiversity change,
- the physical, biological, and societal consequences of changes in biodiversity, and
- the strategies for effectively conserving, managing and restoring biodiversity.

Meeting these challenges requires broad interdisciplinary engagement spanning the biological, physical and social sciences, the humanities and arts, and engineering and technology. The University of Wyoming has a long-standing tradition of excellence in research and education in ecology, the Earth and environmental sciences, and natural-resource economics, and has developed a number of interdisciplinary programs, collections and other assets that will support an initiative in biodiversity science and conservation.

The elements of the Wyoming Biodiversity Initiative will include the following, each of which is described in further detail in the report:

I. **Research.** The Biodiversity Initiative will advance understanding of biodiversity through a statewide program of inventory, monitoring and assessment. It will promote the development of tools to support and improve decision-making processes, including technologies for measurement and monitoring, computational capacities for analysis and assessment, conceptual models for anticipating and forecasting threats and opportunities, and decision tools for minimizing risk and maximizing gain in an uncertain and changing future.

II. **Education.** An interdisciplinary group of faculty will develop and offer programs — beginning with a bachelor's degree — in Biodiversity Studies, a field that combines the study of biodiversity science with the study of human interaction with biological diversity. The initiative will support student research, field experiences, and internships.

III. **Outreach.** The Wyoming Biodiversity Initiative recognizes the central role citizens and decision-makers play in conservation of biological diversity. Initial projects involving partnerships across UW and dialogue with citizens and stakeholders will include a Wyoming Atlas of Natural History and website, a Wyoming Biodiversity Science electronic clearinghouse, a Citizen Science program, and programs that provide extension and outreach in biodiversity conservation and continuing-education opportunities for land managers and other professionals.

IV. **Administration.** The Wyoming Biodiversity Initiative will be administered by leading scholars in the field who will serve as director and associate directors. This leadership team will coordinate an interdisciplinary group of dedicated and affiliated faculty, and will oversee academic professionals, post-doctoral scholars and staff.

V. **The University of Wyoming Biodiversity Complex.** The Wyoming Biodiversity Initiative will be enhanced by dedication of a new or remodeled building to provide space for faculty, staff, students, and visiting scholars, for research laboratories, and for workspace for collaborative projects involving UW personnel and stakeholders.

The Wyoming Biodiversity Initiative will provide benefits for the University and the state of Wyoming, with impacts far beyond the state's borders. It will provide the University with a unique identity as a center of integrated research, education, and outreach on biodiversity, providing a model that other institutions are likely to emulate. The Initiative will provide novel solutions to some of the most difficult challenges facing human society. It will develop ideas and applications, often using Wyoming as a test-bed, which can be applied and adopted in the state and in other parts of the nation and the world. It will continue to bolster UW's ability to recruit outstanding faculty members, not only in the life and environmental sciences but more broadly across the campus. It will foster greater interdisciplinarity in research and scholarship, and in education and curriculum. The Initiative will develop a unique, pioneering undergraduate degree program that may serve as a national model. It will contribute unique outreach programs to assist a wide variety of stakeholders across the state and region, and at national and international levels.

II. INTRODUCTION

Biodiversity has emerged in the past two decades as a unifying concept in the life sciences and environmental sciences. The biological diversity of our planet — the variety of life forms in all their manifestations — is the outcome of several billion years of evolution, shaped by natural processes and recently by the activities of humans. Human activities foster, maintain, and degrade biodiversity across the globe. Biodiversity has important benefits for human society, providing economic opportunities, contributing to its quality of life, and shaping its moral concerns. Changes in biodiversity can thus have significant consequences for human well-being. Understanding biodiversity, the way it impacts human society and the way human society affects it, constitutes a central concern across academic disciplines and requires unusual levels of interdisciplinary engagement. Biodiversity is a particularly important concern to Wyoming, with its economy and ways of life that depend on its unique natural setting and ecological diversity.

The University of Wyoming, recognizing the importance of biodiversity to the state as well as the nation and the world, proposes to develop a campus-wide Biodiversity Initiative. This initiative will build on the University's considerable faculty strength in relevant disciplines, and will establish the University as a national and international leader in the interdisciplinary study of biodiversity. The Biodiversity Initiative will have three dimensions: research, education, and outreach, and all three will reach broadly across the University's constituent academic disciplines and units. As the state's only research university, the University of Wyoming assumes the responsibility to conduct biological diversity scholarship for the purpose of guiding the management and conservation of biodiversity for present and future generations.

This report is a response to a request from the Office of the President to "develop a vision and plan for a UW program in the broad field of biodiversity conservation" (Appendix A). It was prepared by a Task Force comprising 12 UW faculty members (Appendix B), who sought advice from experts on and off campus (Appendix C). These experts were uniformly enthusiastic about an initiative centered on biodiversity. Comments from off-campus experts are excerpted in Box 1.

III. VISION

The University of Wyoming's Biodiversity Initiative (WyBI) will promote research, education, and outreach concerning the study of biodiversity broadly construed. This study includes both the science of biological diversity and the analysis of the interplay between society and the biological variety of the natural world. It will foster the conservation of biodiversity by promoting understanding of the physical, biological, and human forces which impact and shape its character. The initiative's immediate focus will be Wyoming and the Rocky Mountain region, but its endeavors will be informed by and contribute to scholarship globally.

The primary goal of the Initiative will be to foster scholarship concerning biodiversity and the ways in which humans interact with it. Building upon that knowledge, the Initiative aims to engage students and the public in dialogue about biodiversity, human attitudes towards it, and its impact upon human well-being. Through the development, articulation, and application of cutting-edge biodiversity knowledge, the Initiative seeks to promote understanding and appreciation of the living world and its conservation for students and the public at large. It also aims to provide sound, independent and objective, broad-based information on biodiversity management to government agencies, non-governmental organizations, the private sector, and the public at large.

Box 1. What outside experts said about UW's Biodiversity Initiative

Jim Collins, Arizona State University: UW's Biodiversity Initiative can help transform the biological sciences into a new discipline that reaches far beyond biology to encompass physical and social sciences as well as humanities. Dr. Collins urges that the initiative should include forward-thinking ecological ethics to aid ecologists, economists, resource managers, and policymakers in taking actions when confronted with complex conflicts among ethical concerns. No university has yet launched a broadly based, biodiversity-focused program that integrates across a wide range of disciplines.

Sir Peter Crane, Yale School of Forestry and Environmental Studies. A field-based biodiversity monitoring program can serve as a focal point for an institutional initiative, engaging students, citizens, and stakeholders. The program could establish baselines, detect looming threats, and identify best practices. Sir Peter urges UW to make use of "institutions at our doorstep," partnering with agencies, selected NGOs, and stakeholder groups to integrate knowledge and application across the region.

Steve Gaines, Bren School UC Santa Barbara. UW has a big opportunity to capitalize on its strengths in economics and ecology to help develop conservation banking and market solutions as part of its biodiversity initiative. Dr. Gaines believes that Wyoming can serve as a test bed for conservation practice and policy in a politically conservative region with an energy-dependent economy. By developing an initiative focusing on solutions to problems in biodiversity and conservation, UW can develop a unique niche.

Georgina Mace, Imperial College London. UW has a huge opportunity to bring the physical, biological, and social sciences together, and to train students at all levels to communicate across disciplinary boundaries. Professor Mace suggests that UW could be unique by developing a deep, specific focus on biodiversity science and conservation. She knows of no university, anywhere in the world, that is doing this at an institutional level.

Connie Millar, U.S. Forest Service. The University can fill a huge demand in federal resource-management agencies by training students in the physical-science and social-science components of biodiversity conservation, and integrate them with the traditional life-science foundations. Dr. Millar notes that development of tools for measurement, monitoring, and decision-making, together with training workshops, would also fill a large void. No universities are meeting these needs.

Peter Raven, Missouri Botanical Garden. UW can take advantage of its unique setting, biology, and culture, and create a model that can be adopted elsewhere. Dr. Raven sees an opportunity for UW to create a university-wide interdisciplinary initiative, and to develop a unique curriculum in biodiversity studies that produces graduates prepared to deal with the world as it is. Noting that "real conservatives are conservationists", he suggested that UW can lead in developing a vision of nature and society in the interior West for the coming decades.

IV. BIODIVERSITY – AN INTERDISCIPLINARY CHALLENGE

Biodiversity science is ultimately grounded in the life sciences, which are concerned with describing the immense diversity of life found on our planet and understanding the factors that govern that diversity. Many of these factors are biological, including ecological and evolutionary processes. However, they interact with a variety of physical and chemical processes on Earth's land surface and atmosphere and in the earth's oceans and other water bodies. Understanding biodiversity requires integrating biological patterns and processes with geological, atmospheric, geochemical, and geophysical processes, and setting them in context of Earth's dynamic history.

Measuring biodiversity and understanding its dynamics increasingly requires sophisticated tools, drawing from engineering, the computational sciences, and biotechnology.

Humans have influenced biodiversity at local and regional scales in various parts of the world for at least the past 100,000 years, and the influence has accelerated with the advent of agriculture (ca. 6000 – 11,000 years ago), the development of intercontinental trade networks (ca. 500 – 1000 years ago), and the Industrial Revolution (200 years ago). Today, many human influences are affecting biodiversity at a global scale. The biological and physical sciences by themselves cannot explain how human activities are shaping biodiversity. The social sciences play an increasingly important role in understanding the links between human activities and biodiversity. Economics, geography, and anthropology have been particularly prominent in this analysis, but other disciplines increasingly contribute. Understanding the human attitudes that motivate behavior requires other approaches, especially those found in the humanities and the arts. Biodiversity science is thus embedded in a broad approach - ***biodiversity studies*** - which draws on the entirety of the biological, physical, and social sciences, as well as the humanities and the arts, to explore the multiple interactions between humans and biodiversity. Scholars in disciplines as diverse as philosophy, art history, literature analysis, and religious studies are deeply involved in biodiversity studies.

The relationship between human societies and biodiversity is not unidirectional. Human activities influence biodiversity, but changes in biodiversity, both natural and human-driven, in turn affect human societies and economies at local to global scales. A major current focus aims to understand "ecosystem goods and services" – the economic benefits to society conferred by living organisms and the agricultural, managed, and unmanaged ecosystems of which they are components. These benefits range from direct economic goods (fresh water, fisheries, timber, nut crops) and services (nature-based recreation and education) to specific ecosystem services (pollination of crop plants; predator control of pests) to more diffuse ecosystem services (flood control; erosion prevention; carbon sequestration). Such benefits are increasingly recognized in management, policy, and law. They are enhanced by some human activities and weakened by others. The development of sound policies and management requires engaging a broad range of disciplines in the sciences and humanities.

Biodiversity also affects human health. Approximately 75% of emerging human diseases (e.g., HIV, lyme disease, ebola) can be traced to other species, and human and veterinary medicine, public health, and epidemiology are drawing on biodiversity science to understand such linkages. Sixty percent of pharmaceuticals currently in use were first discovered as natural products of wild plants, animals, and microorganisms. "Bioprospecting" for new drugs and other valuable natural products is a major focus of discussion involving biodiversity science, economics, anthropology, business, and medicine, as well as international law and policy.

Finally, biodiversity confers broad societal values. Cultures across the globe derive aesthetic and spiritual value from the natural world. Many religious texts, beliefs, and practices shape attitudes towards plants, animals, and natural landscapes, and are in turn shaped by the natural world. In some cultures, the behavior of living creatures influences ethical principles, serving as positive or negative examples for human behavior. Aesthetic expressions in literature, poetry, music, dance, and art in western and other cultures have arisen from various aspects of biodiversity. In turn, the attitudes, beliefs, and values expressed in these human activities and expressions shape how societies and cultures perceive and treat the living world around them. For example, the biodiversity of a locale or region imparts a strong sense of place. For residents as well as visitors,

"Wyoming" elicits images of pronghorns, sagebrush, golden eagles, lodgepole-pine forests, or cutthroat trout. The values inspired by these images in turn reinforce particular attitudes toward the state, its people, and its landscape.

Stakeholders in biodiversity, including resource managers and policymakers, but also teachers and other citizens, need sound scientific knowledge on which to base decisions. Decision-makers need to be able to set priorities and assess consequences as they face rapid ecological changes in an uncertain future with finite financial resources for implementation. Such decisions draw not only on scientific knowledge, but on assessments of value – economic, ethical, aesthetic, and other. Meeting the great environmental challenges of the 21st Century will require extraordinary engagement and effective communication among diverse academic disciplines, and between the academic scientists and scholars and the many societal stakeholders.

The University of Wyoming is poised to become a national and international leader in biodiversity studies, including:

- Generation of new knowledge concerning biodiversity and its valuation and conservation
- Education of a new generation of interdisciplinary biodiversity scholars and scientists
- Providing much-needed tools, training, and resources to stakeholders for decision-making and problem-solving

The Wyoming Biodiversity Initiative will span the entire University, building on its strengths in life, social, and environmental sciences, and drawing on the University's unique position as a diverse liberal arts institution, a land-grant institution, and the only research university in the state. The Initiative will offer opportunity for links with every corner of the University (Appendix D).

The Initiative will be based at the University, but will seek to establish partnerships and relationships with diverse entities and stakeholders (citizens, schools, non-governmental organizations, private industry, and government agencies at local, state, federal, and international levels). These partnerships and relationships will ensure that the Initiative meets real-world needs and also provides resources and opportunities to the University. The Initiative will be centered on Wyoming and the surrounding Rocky Mountain region, but will include activities and impacts spanning the United States and the globe. By means of the Initiative, the University of Wyoming will establish itself as a national and international leader and model.

V. PROPOSED STRUCTURE FOR THE BIODIVERSITY INITIATIVE

The Wyoming Biodiversity Initiative will comprise three integrated components: research, education, and outreach. These components will be administered under a common framework. They will partner with academic departments, colleges, schools, and other units to ensure stable and influential embedding of the Initiative across campus. Co-location of Biodiversity Initiative faculty and staff in a single building will foster interdisciplinary communication and collaboration and generate the greatest benefits for the University.

A. WyBI Research

The University of Wyoming is already nationally and internationally recognized in ecology, environmental sciences, natural resources, and environmental and resource economics for its

contributions to biodiversity science. With its existing expertise in these areas, the University is poised to provide global leadership in the interdisciplinary research and scholarship needed to address the central challenges in the field. But to do so, the University needs to develop an integrated campus-wide approach to fostering and sustaining biodiversity studies. The WyBI research programs will provide a variety of long-term as well as more targeted and short-term funding mechanisms to cultivate new synergistic linkages that will foster interdisciplinary biodiversity studies across campus. The research programs will be coordinated with the outreach programs to ensure dissemination of relevant research results, ideas and applications through public engagement. The research programs will build on the University's existing strengths in biodiversity science, and encourage wider participation of academic researchers and units in the art, humanities, natural sciences, and social sciences in pursuing biodiversity research.

By virtue of its proximity to a diverse array of unique ecosystems and species in Wyoming, the University can utilize a unique set of outdoor laboratories for research and scholarship in biodiversity. Thus, the primary geographic focus of WyBI programs should be on biodiversity in Wyoming and the Rocky Mountain region. However, if the University is to become a new global model for interdisciplinary biodiversity science and studies, then these efforts should also be informed by and contribute to scholarship globally. Biodiversity research at the University of Wyoming should also be devoted to improved public understanding and management of not only local and regional environments but also the world's unique natural heritage of biodiversity.

With these goals in mind, the proposed WyBI research and scholarship programs at the University of Wyoming aim to develop integrated understanding of:

- the dimensions of local, regional, national, and global biodiversity,
- the physical, biological, and societal processes that govern biodiversity change,
- the physical, biological, and societal consequences of changes in biodiversity, and
- the strategies for effectively conserving, managing and restoring biodiversity.

Although the immediate focus of such research and scholarship efforts will be Wyoming and the Rocky Mountain region, WyBI activities in these areas will also have national and international components, leveraging faculty strengths and addressing important challenges.

Meeting these challenges requires broad interdisciplinary engagement, spanning the biological, physical and social sciences, the humanities, the arts, and engineering and technology. The life and environmental sciences are necessarily at the core of this enterprise. However, they are not sufficient to address many of the most important and difficult questions. Similarly, environmental and natural resource economics may assist in determining the valuable services, or benefits, arising from biodiversity and ecosystems, but other considerations are often required in assessing biodiversity conservation and management options. In a changing and uncertain future, sound scholarship and thoughtful consideration of values will be needed for wise management and policy decisions. Both challenge and opportunity lie in engagement of the core sciences with other disciplines, which could potentially include any academic discipline represented in the University. As both a diversified liberal-arts university and land-grant institution, the University has opportunity to contribute to virtually every aspect of biodiversity research, from the arts and the humanities to economics and the social sciences to the physical and life sciences.

Three areas of critical need and opportunity are emerging that will require unprecedented interdisciplinary research engagement:

1. ***Place-based understanding.*** Fundamental understanding of biodiversity and its controls and consequences requires inventory, monitoring, and assessment in both pristine and disturbed settings. The relevant processes involve physical, biological, and societal dynamics that play out across a broad range of temporal and spatial scales. Wyoming's unique geographic and cultural setting and its landscape diversity offer abundant opportunities for place-based research and scholarship. At the same time, research and scholarship centered in the intermountain West, in other parts of the United States and in selected international locations, will provide different perspectives enabling revealing comparisons.
2. ***Tool development.*** Scientists, resource managers, policymakers, and other biodiversity stakeholders are in need of a variety of tools to support and improve decision-making processes. These tools vary widely in scope, encompassing technologies for measurement and monitoring, computational capacities for analysis and assessment, conceptual models for anticipating and forecasting threats and opportunities, and decision tools for minimizing risk and maximizing gain in an uncertain and changing future.
3. ***Creating a desirable future.*** The future state of biodiversity at local to global scales will depend to a large extent on decisions made by people. Some of these decisions will utilize scientific knowledge and perspectives, but all will draw on human values – economic, aesthetic, and ethical. Decisions ranging from management of an individual land tract to policy at national or international levels will increasingly involve tradeoffs among conflicting values and value systems. Scientific knowledge contributing to such decisions will carry substantial uncertainties. Developing the frameworks for setting priorities, weighing risks and benefits, and taking actions in an uncertain and rapidly changing world constitutes a major challenge that will require deep interdisciplinary engagement.

The WyBI will support and advance these areas of critical needs and opportunities in biodiversity research by implementing the following components, which will be coordinated by an Associate Director for Research.

1. ***Wyoming Biodiversity Observatory Network (WyBON).*** Real-time observation – including inventory, monitoring, and assessment – is critically important to delineate baselines, detect changes, identify causes, and support decision-makers. The Biodiversity Initiative will launch a program aimed at leveraging existing activities and data, and developing a coordinated, statewide biodiversity observational network. WyBON will have two components, one extensive and statewide, the other intensive and concentrated in southeastern Wyoming. The statewide component will provide support on a competitive basis for improvement of existing observational programs, opportunistic revival of dormant programs, and synthesis of existing data from sites across the state. The intensive component will focus initially on developing baseline inventories, permanent plots, and environmental instrumentation along the elevational gradient from short-grass prairie and sagebrush steppe in the Laramie Basin through montane and subalpine forest to tundra at the crest of the Snowy Range. Both components of WyBON will be closely coordinated with the WyBI Education and Outreach programs, providing a set of "outdoor laboratories" for teaching and yielding data and assessments for decision-makers.

2. ***Biodiversity Research and Infrastructure Development Program.*** This competitive funding program will provide support for personnel and physical infrastructure to further

develop long-term biodiversity scholarship at the University of Wyoming. This will include (a) bridge-funding and startup for new cross-cutting faculty hires, (b) increased capacity and capabilities for existing research facilities relevant to biodiversity, (c) development of new core facilities focused on biodiversity, and (d) sponsorship of visiting scholars and postdoctoral research fellows. In all cases, funds will be dedicated to support scholarship and infrastructure that will have broad impact, spanning multiple departments or disciplines. Funds will be allocated on a competitive basis, using both internal and external reviewers.

3. ***Biodiversity Research Venture Funding Program.*** Competitive funding will be provided for transformative, interdisciplinary research in new areas, aimed at addressing cutting-edge problems in interdisciplinary arenas often difficult to fund through traditional funding sources. These will be relatively fast-turnaround projects, anticipated to be high-impact. Projects will be led by UW faculty members, and should involve at least two UW faculty members, but collaborations and partnerships from outside UW (other universities, government agencies, NGOs, foundations) will be strongly encouraged. External partners may provide matching or in-kind support, participate as collaborators, or both. Projects may focus on a wide variety of topics, ranging from basic research to development of measurement and decision tools for use by conservation practitioners. Any UW faculty member with research or scholarly interests relevant to biodiversity studies, science, or conservation may apply for these funds. Funds will be allocated competitively based on internal and external reviews. Examples of the topical breadth that might be supported under this program are outlined in Box 2.

4. ***Biodiversity Research Opportunity Funding Program.*** This program will complement the Venture Funding Program through small grants that enable relevant, short-notice activities such as matching support or co-sponsorship of workshops, conferences, and other collaborative activities, short-term bridge-funding, small seed grants to foster submission of large collaborative grants, and doing initial measurements to seize short-term opportunities (e.g., following a major disturbance such as beetle outbreak). These funds will be allocated based on internal review.

5. ***Biodiversity Summit.*** Wyoming will receive prominent attention for sponsoring and hosting a biennial Biodiversity Summit. These will comprise conferences of leading international scholars in the biological diversity and conservation communities, with limited numbers of participants invited to contribute to synthesis in a particular theme area of topical interest. Summit participants will be selected not only on the basis of their expertise, but their ability to engage openly and intensively in interdisciplinary discussions. The Summits will be aimed at fostering lateral thinking to drive creative solutions and novel breakthroughs in critical areas of biodiversity science and conservation. Each Summit will yield a high-visibility product (synthesis article, journal issue, or book). These Summits will be proposed and organized by UW faculty, though they will be encouraged to bring in outside partners as co-organizers. Summit proposals will be competitive, and evaluated by both internal and external reviewers.

Finally, every effort will be made to coordinate the above long-term, short-term and targeted biodiversity research programs with the education and public engagement activities planned under WyBI. For example, the infrastructure emplaced in WyBON can serve as elements of a field laboratory for university classes and a variety of outreach activities, from K-12 education to instrumentation workshops for agency and NGO personnel.

Box 2. Example Topics of Study for the Biodiversity Research Venture Funding Program. These topics are intended to be representative of the breadth of interdisciplinary and integrative studies that could be undertaken under this program. They are in no way exhaustive, nor intended to be prescriptive.

- *Developing commercial seed sources for ecological restoration in a changing climate*
- *How will increased demand for Wyoming coal (or wind power) affect local and regional biodiversity?*
- *Towards an improved microsensor for* in situ *tracking and monitoring of ground-dwelling insects*
- *Will emerging "green theologies" in evangelical and other Christian sects change the political landscape for conservation?*
- *Economic and sociological assessment of predator-damage payment programs*
- *How might climate change affect the phenology of plant-pollinator mutualisms in a montane region?*
- *Economic valuation of ecosystem services and biodiversity in unique Rocky Mountain habitats*
- *Cyberinfrastructure for dispersed sensor arrays in remote mountain locales*
- *Integrated economic and ecological analysis of biological invasions in the interior West*
- *Testing a collaborative decision-making framework in a contentious socio-political setting*
- *Managing the products of succession to restore ecosystem services after the bark-beetle outbreaks*
- *The avian arts: Wyoming birds in painting, poetry, and performance*
- *Effective management of native fisheries in the face of invasive species and drought*
- *Do extreme weather events pose threats to sustainability of threatened populations?*

B. WyBI Education and Curriculum

The educational centerpiece of the Wyoming Biodiversity Initiative will comprise an undergraduate major in Biodiversity Studies, a cutting-edge field that combines the study of biodiversity science *sensu stricto* with the study of human interaction with biological diversity. Available as both a BS and a BA, the BDS major will pair with a major in a traditional discipline. Students will therefore undertake two majors, one providing discipline-based expertise in a recognized field and the other imparting ability and opportunity to apply that expertise to issues in biodiversity. Once this degree has been established, development of academic minors and graduate-level degree programs will be pursued.

With the variety of academic approaches to the living world discussed in Section IV, it is not surprising that the field of biodiversity studies is broad and cannot be mastered by a single individual or even a small group of individuals. By establishing a major that is designed to be paired with a second, this curriculum will enable students to choose their approach to the issues relating to biodiversity and develop their strengths in that area.

Organization of the Biodiversity Studies Major

Biodiversity science constitutes an integrated field, which at UW draws upon long-established strengths described in Appendix D. The study of human endeavors, activity and products likewise

has a strong precedent here at the University. The Biodiversity Studies degree will bring together a scientific education in biodiversity and its conservation—rooted in a biological understanding of the variety and dynamics of life within ecosystems—with a grounding in courses from the social sciences and humanities. The latter will help students understand the extent of human engagement with biodiversity and how factors as disparate as relative wealth, religious belief, and public debate shape attitudes towards the natural world. These two emphases will enable students to examine biodiversity from multiple scientific and non-scientific perspectives, and explore how those views shape how biodiversity is understood and treated. In brief, our majors will graduate with a firm grounding in biodiversity science together with a sound understanding of the social and cultural factors that shape human interactions with the natural world.

Biodiversity science constitutes this degree's central focus, with courses emphasizing different aspects of biology, biodiversity, ecology and cognate sciences at both the lower and upper levels. It will also require courses teaching the supporting mathematics and statistics.

The analysis of human society and the ways it impacts biodiversity is broad—as broad as the study of human society itself. Some of that breadth of study needs to be available in this degree. In recent decades, however, the importance of biological variety to human society has featured in two main areas: economics and politics. The economic valuation of ecosystem services provided by biodiversity in natural and managed settings is widely applied to address the human benefits deriving from biodiversity and to evaluate changes to those benefits that might come from human activities. However, many human activities that affect biodiversity are debated and decided in the political realm, where science, economics, policy, and law intersect, and non-economic values (including ethics and aesthetics) play a major role. Accordingly, the degree should include grounding in both economics and politics as they relate to biodiversity issues.

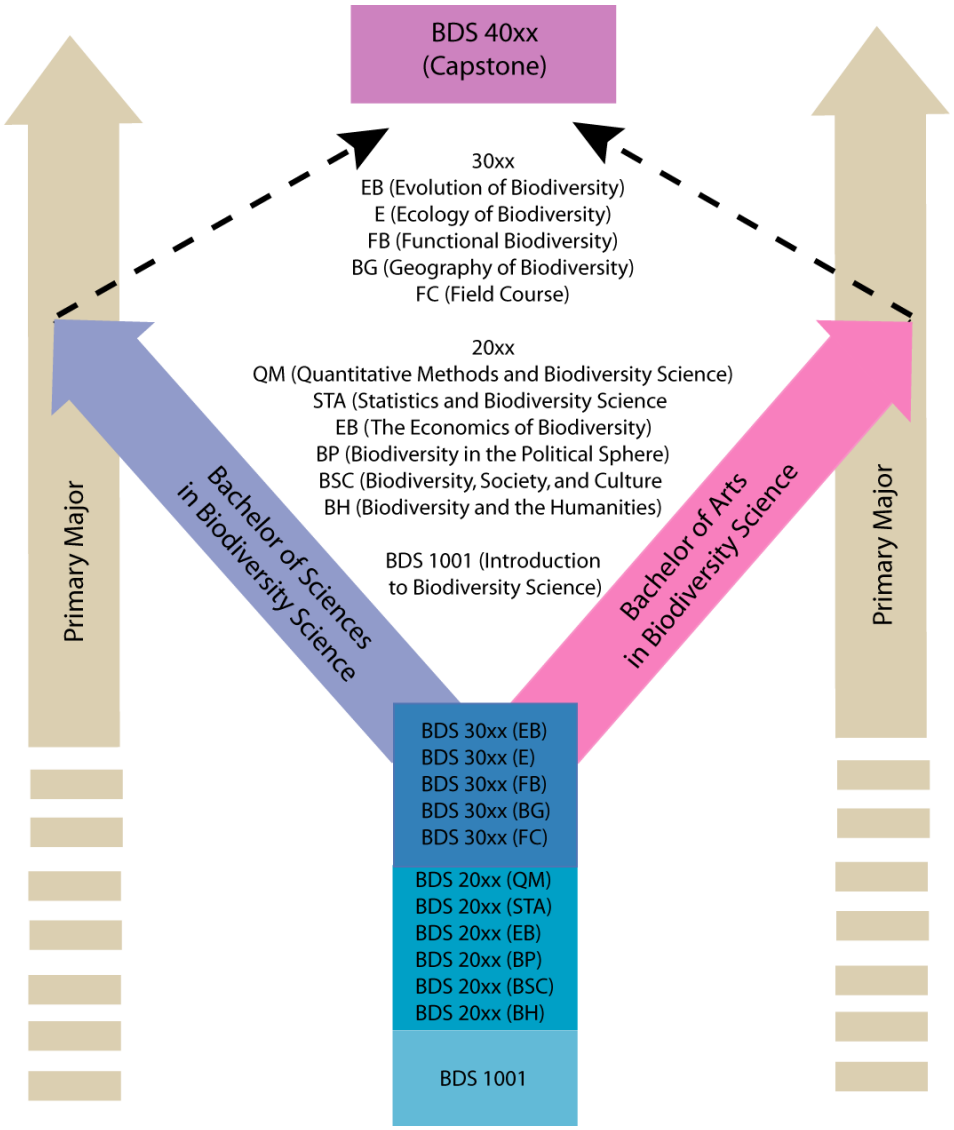
Sample Design for the Biodiversity Studies Major

While the specific requirements and detailed structure of the Biodiversity Studies degree will be designed following the launching of the Initiative, a possible organization of this major following the above goals is presented below.

The Biodiversity Studies degree comprises a single major in which a student can take either the B.S. track or the B.A. track. As discussed above, the degree program aims to provide individuals grounded in specific disciplinary majors with breadth and depth in biodiversity studies. The biodiversity studies major should thus be understood as an enhancement and complement to a student's primary degree. It consists of 13 courses, for a total of 40 credits. Six of the courses will focus on biodiversity science proper, while four will emphasize biodiversity in the social sciences and humanities. The other three will comprise two mathematics courses and the capstone course.

The major's curriculum will consist of courses designed specifically for the major, although some will be available to students outside the major. These courses will be taught by faculty attached to the Biodiversity Initiative, including some in new positions created specifically for this degree. Many courses will meet requirements for UW's University Studies Program.[1] This will limit the "credit creep" inherent in many double majors. (The interaction between the Biodiversity Studies major and University Studies is illustrated in the accompanying figure.)

[1] The details will change as University Studies is redesigned in the coming year.



Course Requirements:

1000-level		Credits	USP
	Introduction to Biodiversity Science (with lab)	4	SB/"S"
2000-level			
	Quantitative Methods and Biodiversity Science	3	QA
	Statistics and Biodiversity Science	3	QB
	The Economics of Biodiversity	3	CS
	Biodiversity in the Political Sphere	3	CS
	Biodiversity, Society, and Culture [1 from list below]	3	CS/CH
	Biodiversity and the Humanities [1 from list below]	3	CH
3000-level			
	Evolution of Biodiversity	3	WB
	Ecology of Biodiversity	3	L
	Functional Biodiversity	3	
	Geography of Biodiversity	3	G
	Field Course	3	
4000-level			
	Capstone in Biodiversity Studies	3	WC
		40	28

Notes:

1. Courses in this degree cover 28 credits of USP courses. USP completion will require up to 19 credits to be taken in other courses.
2. The aim of the capstone course will be to synthesize aspects of biodiversity science with issues relating to human society and thought. This course will include working on a senior thesis in teams that bring the two areas together. It will be led byWyBI's Associate Director of Education coordinator, with assistance from faculty members in life sciences, social sciences and humanities.
3. We will encourage students to undertake capstone projects proposed by industry, NGOs, or government agencies. This will help in developing internships, job networking, and real-world experience.
4. Biodiversity, Society, and Culture – example course options (list to be limited to 3-4 courses):
   Biodiversity in the National and International Political Sphere
   Human Dimensions of Biodiversity
   Biodiversity and the Cultural Landscape
5. Biodiversity and Humanities –example course options (list to be limited to 3-4 courses)
   Philosophy, Ethics and Biodiversity
   Religion, Science and the Environment
   Literature, Art and Disease

Design and Implementation

The curriculum of the Biodiversity Studies major and other degrees will be designed by a broad-based faculty committee drawn from associated departments and centered in the Biodiversity Initiative. It will be implemented by the Associate Director for Education of the Biodiversity Studies Program.

The committee will take the proposed structure of the major outlined above as a starting point for building and improvement. The proposed courses in the degree are all new and assume that the (new) faculty teaching them will design them to focus on the questions and needs of biodiversity science studies. This will require the hiring of additional faculty positions to ensure this emphasis, in cooperation with interested departments.

Biodiversity Travel and Special Opportunities for Students

Biodiversity conservation must emphasize hands-on experiences, and students planning to pursue careers in this field will benefit from enriching educational experience that can be gained only outside a classroom. The proposed degree requires a course that will take place entirely in the field. The Associate Director for Education will have a fund to support such courses.

In addition, a small-grant fund will provide students with support for undergraduate research, provide travel funds for place-based investigation both locally and abroad, and for internships with appropriate government agencies, and non-governmental organizations. Some courses will require field trips and travel support as well, especially the major's capstone. This fund will also encourage the development of travel courses, both for UW students alone and in concert with students from other universities, both at home and abroad.

Career Opportunities

The proposed double major will give our students a competitive edge if they are interested in pursuing graduate degrees or if they intend to pursue careers in the private sector (non-governmental organizations, industry) or government agencies. It is increasingly recognized that the best candidates for jobs in fields that aim to solve environmental problems are those who

possess not only technical skills and expertise, but also have broad education that allows them to collaborate in problem-solving teams and to interact fruitfully with individuals with different areas of expertise and even worldviews.

C. WyBI Outreach

The Biodiversity Initiative recognizes the central role citizens and decision-makers play in the valuing and conservation of biological diversity. Citizens in Wyoming and similar regions have strong connections to natural history, placing high value on wildlife and natural, undeveloped landscapes. At the same time, many residents depend directly or indirectly on the development of the State's considerable natural resource base and global energy industry for their livelihoods.

Engagement with community leaders and regional to national policy makers has been a core mission of the land grant university since 1914 (Smith Lever Act), and is reinforced in the current academic plan. Successful management of biodiversity and conservation of ecosystem services will enhance and maintain regional social and economic development. It is important that UW faculty engage directly with decision-makers in the State and the region to develop measures needed for biodiversity management.

Outreach is a core and focusing element of the Biodiversity Initiative. Conservation emerges from the intersection of knowledge, values and our economic, social, cultural and political systems, and outreach must bridge all of these components. Conservation is inherently place-based, and the University of Wyoming is situated in one of the world's megafauna-rich regions where human settlement has been sparse throughout time. Most Wyoming ecosystems retain their biological diversity and natural functions, but are increasingly impacted by global demands, particularly for energy. Even renewable energy sources (wind, solar) have biodiversity impacts via the footprint of the turbine or panel arrays and transmission lines. As the State's land grant institution and only research university, UW is poised to offer regional and international leadership to provide the knowledge and tools citizens and decision-makers need to conserve and restore biodiversity in the face of global development forces and climate change in the Rocky Mountain West and regions around the globe. Effective outreach is not a one-way transmission process, but involves active dialogue with diverse stakeholders, ranging from lay citizens and K-12 educators to resource managers and policymakers. Faculty, staff, and students involved in outreach must develop good listening and communication skills in order to engage effectively with the public, and the WyBI Outreach Program will help participants develop and employ those skills.

An innovative and focusing aspect of our outreach efforts will be to utilize natural history as a common language to connect the variety of scientific and cultural aspects of biodiversity with the citizens of the region in a two-way dialogue. A second major component of the BCI's outreach will be developing state-of -the-art approaches, techniques and tools, along with an institutional structure, to facilitate place-based visioning, valuation, and problem-solving related to changes in and conservation of biological diversity. Outreach recognizes the interdisciplinary nature of biodiversity conservation and the need for a wide range of perspectives and expertise in addressing the public's needs to understand implications of biodiversity and biodiversity change. All programs and disciplines at UW have the potential to contribute to this mission.

While biodiversity research aspires to be objective, outreach can be as much an art as a science, and expertise will be needed in outreach communication. Therefore it is important to partner with

existing units on and off campus that have relevant outreach programs. These include the Ruckelshaus Institute of Environment and Natural Resources **(**IENR), Wyoming Geographical Information Science Center (WyGISC), Wyoming Natural Diversity Database (WYNDD), the Wildlife Cooperative Unit, University of Wyoming Ag Extension, the Science and Mathematics Teaching Center (SMTC), and the University Museums. The mix of University faculty contributions to the objectives below will depend upon both interest and capacity of individuals in the units and each academic unit's mission.

The proposed outreach program, which will be coordinated by an Associate Director for Outreach, involves five general goals, with specific objectives and action items.

1. ***Develop novel resources, techniques, and tools to facilitate place-based visioning, valuation, and problem-solving related to biodiversity.***

This element of outreach will comprise four projects, each involving partnerships across the UW campus and with diverse stakeholders in Wyoming and elsewhere. These projects will develop and deliver resources to educators, resource managers, decision-makers, and citizens, and engage these groups in dialogue concerning the biodiversity wealth of the state and region.

a. Wyoming Atlas of Natural History

This project will develop a reference publication and website that details the patterns and dynamics of biodiversity across Wyoming and the Rocky Mountain West using graphic tools and images as well as narrative text. Atlas elements will illustrate and document aspects of biodiversity, including, for example, maps of distribution or abundance of Wyoming species of broad public appeal and interest, and graphical and textual summaries of information about natural history and biodiversity within the state. It will highlight aspects of biodiversity that are particularly well-known (e.g., genetic diversity patterns for species that have been intensively studied), and will also identify the major gaps in our understanding. It will include maps and summaries of various features relevant to understanding biodiversity patterns (e.g., elevation, climate, habitat, land-use, geologic history). Much of the information for the Atlas is already available on campus or elsewhere. The Atlas will be a valuable resource for educators, citizens, and stakeholders, and will also serve the Initiative's Research and Scholarship and Education components.

b. Wyoming Biodiversity Science Electronic Clearinghouse (WyBSEC)

This project will launch a central clearinghouse for the publications, datasets, maps, and analyses relevant to biodiversity science, management, and policy. These resources are currently dispersed among state and federal agencies, non-governmental organizations, universities, and private collections. The WyBSEC will provide a central catalogue and collection of these resources, which will benefit resource managers, decision-makers, and researchers, as well as provide information for K-12 educators and the general public. WyBSEC will be developed in close coordination with agencies, non-governmental organizations, and researchers to ensure that it is broadly accessible and meets stakeholder needs.

c. Wyoming Biodiversity Citizen Science Program

This program will engage the citizens of Wyoming, including students and teachers in K-12 classrooms, to participate actively in biodiversity science and discovery. It will be built on the model of Citizen Science (CS) programs around the country (e.g., the Cornell Laboratory of

Ornithology), matching citizens, schools, organizations, and companies with biodiversity researchers. The central goals would be to generate greater appreciation and understanding of biodiversity science among the general public, and to use networks of citizens across the state and region to make observations useful in scientific research. The program would also create a "shared space," where scientists and interested citizens can engage in dialogues concerning biodiversity.

The program will foster and support locally run Citizen Science groups in communities from Wyoming and potentially across the world. These groups will be locally based, and the University will provide relevant information and expertise when needed, including technical and informational assistance. The program will start with a pilot project linked with the Wyoming Atlas of Natural History, and will expand to encompass other projects, potentially spanning a broad range of topics.

d. Biodiversity Science Tool Development, Deployment, and Training Program

This program will foster a dialogue between the University community and the stakeholder community to identify critical needs for tools (measurement, monitoring, decision, analysis) among the latter groups. It will identify and cultivate potential partnerships between University researchers who can develop needed tools and relevant stakeholder groups. The program will facilitate field-testing of these tools with the stakeholder groups, as well as advise UW researchers in deploying the tools and training potential users.

2. Foster mutually productive dialogue between the University biodiversity community and resource managers and conservation professionals

This outreach element will be targeted primarily toward resource managers and conservation professionals in Wyoming and the region, and is aimed at engaging these stakeholders and the University's biodiversity community in a productive dialogue, so that University personnel understand the needs and perspectives of the conservation and management communities, and so that those stakeholders can more effectively utilize the resources and products offered by the University. It will thus comprise two complementary programs.

Both venues will allow researchers and graduate students to present results of ongoing research in biodiversity science, policy analysis, and monitoring to those individuals and agencies that are involved in implementation of biodiversity conservation policies. These programs will also create a forum where practitioners can discuss issues and concerns about biodiversity conservation and management related to their particular jurisdiction or region.

a. Field Workshops and Training Program

The Initiative will sponsor Field Workshops in which University faculty and staff will visit land managers onsite to provide training and dialogue about techniques related to monitoring and assessment, strategies for protection, and methods for restoration of ecosystem services and biodiversity. These workshops will be initially concentrated in Wyoming, but as needs and partnerships develop, they may also be conducted in other regions and countries. These Field Workshops will provide a venue for specialists and researchers to interact with land managers in the field rather than expect the latter parties to travel to the University. Many professionals have little time or budget to travel to a centrally located venue, so this program will bring current research and scholarship to them. This program can include both faculty- and student-driven research.

b. Biodiversity Conservation Fellows Program

The Fellows Program will bring agency personnel, land managers of NGOs, and land managers of private companies to campus to work with researchers, educators, and students on practical aspects of biodiversity management. Fellowships may last from a week to a year, and the program will target agency managers, resource policy analysts, and staff from non-governmental organizations who are concerned with biodiversity management and conservation. Fellows will receive funding to support short-term assignments on campus to develop collaborations with researchers and specialists, mentor undergraduate and graduate student research, and instructional work related to the individual's professional work experience and mission in the classroom. The program will focus initially on individuals working in Wyoming and the surrounding region, but will eventually include fellows from other regions and nations.

3. Develop a cadre of University scholars committed to biodiversity-related outreach

This project will develop a cadre of University faculty and professional staff, including natural and social scientists, communication specialists, collaborative-process experts and practitioners, and education experts, who will be committed to engaging with the public on biodiversity issues. The mission of this project will be to:

- Develop age-appropriate educational materials on implications of biodiversity and biodiversity change in the region. These materials would be used for both the Wyoming Atlas of Natural History and Citizen Science Program, as well as other publications.
- Develop tools and techniques to effectively manage biodiversity and biodiversity change on private and public lands for use by relevant stakeholders.
- Develop field workshops for dialogue, training, and technology transfer to professional land managers in the private and public arena.

This group would eventually manage multiple outreach activities including field workshops, the Fellows program, and the Citizen Science program. At the core will be three new specialists, specifically hired to focus on biodiversity outreach. These positions would have extension/outreach appointments with research as the only other component.

4. Award yearly prizes in biodiversity research and conservation.

This element will be directed toward recognizing and rewarding outstanding contributions to biodiversity conservation. The scope for both awards will be broad, and the awards will bring attention to the Wyoming Biodiversity Initiative as well as to the recipients. There will be two awards, one for researchers and the other for citizens. The awards will be conferred in an annual symposium sponsored by the Initiative.

a. Research Award for Biodiversity Conservation

This award will be granted to an individual whose research and public engagement have made outstanding contributions to biodiversity conservation.

b. Citizen Award for Biodiversity Conservation

This award will be conferred on an individual or public group not associated with a University for contributions to public understanding and advancement of biodiversity conservation.

5. Launch a Monthly Seminar Series in Biodiversity Studies

To bring the campus biodiversity community together on a regular basis, and to promote dialogue between the University and stakeholders, the Initiative will sponsor a monthly forum for exchange of ideas and perspectives on biodiversity. Invited speakers will be selected based on their ability to convey broad perspectives and novel ideas to a broad audience. The series will attract students and faculty from across campus as well as stakeholders from the state and community. Many speakers will be drawn from the stakeholder population (e.g., agencies, NGOs, law firms, policy institutes, private industry).

D. WyBI Administration

The administrative structure of the Biodiversity Initiative will ensure that there is excellent communication among the research, education, and outreach components of the program, while also ensuring continuity of mission, and a sense of community and shared mission for faculty and staff.

To maximize the visibility and stature of the program, as well as the continuity of mission, the program will need a Director. The Director should be an internationally recognized figure in an aspect of biodiversity, who has the professional accomplishments that merit appointment at full professor rank. The Director will be most effective as an advocate for the program if he or she is a member of the UW Deans and Directors group.

The Director will oversee Associate Directors for each of the subcomponents: Research, Education, and Outreach. These Associate Directors will provide leadership and management of their subcomponent.

To ensure that the Biodiversity Initiative maintains the engagement of a diverse array of disciplines, the Director and Associate Directors will be assisted by a Biodiversity Initiative Executive Council comprising UW faculty members who represent the key colleges and departments involved. Subcommittees for the research, education, and outreach programs will consist of Executive Council members as well as other relevant faculty members.

The Director will also be advised by an external Advisory Committee, comprising national and international leaders in biodiversity science and biodiversity studies. The Advisory Committee will meet annually to review programs and progress, and provide written feedback to the Director.

E. The University of Wyoming Biodiversity Complex

In its first six months, the new Berry Center has accelerated a transformation in the University culture. Co-location of offices and laboratories, together with social space and meeting rooms, is facilitating unprecedented interactions and collaborations among faculty, students, and staff from a variety of units, including many who do not have office space in the Center. The “buzz” from the Berry Center is being felt across campus. The Berry Center is now completely full, with more than

60 people occupying offices and laboratories and dozens of others using its facilities on a daily basis.

The Wyoming Biodiversity Initiative will involve hiring of many new faculty and staff. Existing buildings on campus, including the Berry Center, lack space to accommodate the personnel needed to implement the Initiative. The Task Force recommends that a new or remodeled building be dedicated to the Biodiversity Initiative. Ideally the building should be on the northwest corner of campus (9^{th}-10^{th} and Lewis Street), in close proximity to the Berry Center and the Enzi STEM Building, in order to concentrate biodiversity and related activities in one part of campus.

The building should include space for administration of the Biodiversity Initiative, offices for faculty, graduate students, visiting scholars, and post-doctoral scholars, and research laboratories.

The building should be specifically designed to maximize interactions among users and occupants, including ample social space for discussions and meetings. Interdisciplinary research and scholarship are fostered by collocation of scientists and scholars. A facility in which diverse scholars are housed can counteract the strong gravitational forces of departments and disciplines, and provide a shared space for collaboration and discussion. A new or remodeled building, specifically designed to provide effective workspace to meet the needs of diverse scientists and scholars but also maximizing the interactions among them, would go far toward creating a "culture of biodiversity" on the UW campus.

The new facility would build on the success of the Berry Center. Many faculty members would have permanent space in the building. A number of offices, laboratories, and other rooms would be set aside and assigned on a rotating basis for researchers and scholars from across campus to occupy for time periods ranging from 3-4 months to 1-3 years, during which they would engage deeply in biodiversity issues.

VI. FUNDING REQUIREMENTS AND IMPLEMENTATION

A. Academic Personnel.

a. **Biodiversity Initiative Director.** The Director should be an internationally recognized researcher in biodiversity with administrative experience and visionary capabilities. This person will be appointed at the rank of Professor.
b. **Biodiversity Initiative Associate Directors (3).** These individuals should have substantial relevant experience and reputations in their respective domains (research, education, outreach). Appointments will be at the rank of Associate Professor or Professor (or equivalent).
c. **Tenured or Tenure-Track Faculty (12).** These positions, which do not include the Director and Associate Directors, will particularly support the research and scholarship and education components of the project, though all will be expected to contribute to outreach activities. These positions will be filled by individuals with proven ability or clear potential for interdisciplinary engagement and collaboration in scholarship and teaching. This cohort of faculty will provide sufficient depth and diversity to constitute a critical mass to develop and consolidate the Initiative. Approximately half these positions will be devoted to science, technology, and engineering disciplines, and half to humanities, social sciences, and arts.
d. **Academic Professional Faculty (10).** These positions will support outreach, education, and research programs in various capacities. Individuals will be recruited

based not only on their skills and credentials, but on their willingness to commit to a collaborative enterprise and to serving a broad community (which in specific cases might comprise researchers, students, or stakeholders).

B. Staff.

1. **Administrative Staff (3).** An accountant and two office associates will be required for administration of the Initiative.
2. **Research Staff (3).** Technicians will be required for the monitoring program and for core research facilities.

C. Post-doctoral Scholars and Graduate Students.

1. **Post-doctoral scholars (3).** Post-doctoral scholars will be recruited for two-year appointments, to participate in novel, cross-cutting research and scholarship. Post-doctoral scholars will work with multiple faculty members, often from different disciplines. They will receive training and experience in leadership, communication skills, and stakeholder engagement.
2. **Graduate Assistantships (4 MS-level, 4 PhD-level).** Graduate assistants will provide support for many of the Initiative's activities, including research and scholarship, education, and outreach components.

B. Implementation.

1. **Research and Scholarship.** Funds are required to initiate and maintain WyBON activities, to support the biennial Biodiversity Summit, to underwrite faculty hires and facilities development, and to support the Venture Funding and Opportunity Funding programs.
2. **Education.** Funds are required for development of new courses, release-time for curriculum and course development, field-trip budgets, undergraduate research stipends, and funds for an international course.
3. **Outreach.** The Outreach component will require material resources for the Wyoming Atlas of Natural History, the biodiversity science clearinghouse, the Citizen Science Program, Biodiversity Conservation Fellows program, stakeholder workshops, awards program, monthly seminar series, and travel and materials for outreach liaison and delivery.
4. **Administration.** This will include an operations budget for the Initiative office, and startup for faculty hires.
5. **University of Wyoming Biodiversity Complex.** This comprises renovation or construction costs for a building dedicated to the Initiative.

VII. METRICS FOR SUCCESS

Start date	Deliverable	Completion date	Product
0 months	Initiate search for Biodiversity Initiative Director	10 months	An internationally recognized biodiversity scholar is hired to provide leadership for the Initiative
0 months	Hold first Biodiversity Summit conference	18 months	Published conference and proceedings volume
0 months	Continue Berry Center education and outreach activities	ongoing	Continued funding of ongoing activities
6 months	Gain UW approval for biodiversity studies major	24 months	First class of students enrolled in biodiversity major
6 months	Establish Wyoming Biodiversity Science Electronic Clearinghouse	12 months	Dynamic website is online
6 months	Convene task force for long-term monitoring program development (WyBON)	18 months	Staff are hired and long-term monitoring program is begun
12 months	Initiate search for three Associate Directors	22 months	Associate Directors are hired to coordinate the Research, Education, and Outreach programs
12 months	Form committee for Wyoming Atlas of Natural History	24 months	Publication of Atlas (print volume) and associated website
12 months	Establish Citizen Science pilot program	24 months	Dialogue between UW scientists and citizen scientists has started
12 months	Support new faculty and AP hires	5 years	Three to four new tenure-track faculty and AP positions are filled per year, each starting new research, teaching, and outreach responsibilities
12 months	Support graduate assistants, post-docs and visiting scholars	5 years	Graduate students, post-docs, and visiting scholars develop research, teaching, and outreach in new directions
12 months	Launch Venture Funding program	ongoing	Transformational interdisciplinary biodiversity research is supported
18 months	Launch Opportunities Funding program	ongoing	Short-notice opportunities are exploited and supported
24 months	Launch Biodiversity Studies major	ongoing	Undergraduates are educated to understand, value and communicate biodiversity and conservation issues
24 months	Award first biodiversity travel grants	ongoing	Hands-on field experiences are provided for students and scholars
24 months	Launch Biodiversity Science Tools and Training program and engage conservation professionals	ongoing	Partnerships between UW personnel and conservation professionals are developed
24 months	First awards for external, internal biodiversity outreach and research	ongoing	Start of Biodiversity Prizes, awarded annually

VIII. **INSTITUTIONAL AND PLANNING CONTEXT**

A. Institutional Planning.

Throughout three cycles of university planning, UW has identified areas of distinction in which the institution has an existing foundation in faculty expertise and a commitment to sustained and increasing prominence. These areas include:

- Life sciences
- Environment and natural resources
- Critical areas of science and technology
- Cultural assets, arts, and humanities
- History and culture of the Rocky Mountain region
- Professions critical to the state and region.

Their selection was far from arbitrary; they were identified as areas that Wyoming and the Rocky Mountain region must cultivate in order to build (in the words of Wallace Stegner) "a society to match its scenery." The list is deliberately broad in order to engage faculty and students from across the institution, not just in a small number of marquee departments. The first two areas are visibly relevant to the Biodiversity Initiative, and the Initiative can contribute to all six in substantive ways, as indicated in Section C below.

The University's academic planning process includes a unique component, central position management (CPM), which allows reallocation of faculty positions on a competitive basis among departments and colleges when vacancies arise from resignations and retirements. This system allows the institution to redirect resources toward areas of distinction identified in the Academic Plan, and provides incentives for departments and colleges to align their faculty position requests with institution-level planning priorities. The Biodiversity Initiative provides a broad theme, linking all six areas of excellence, and allowing diverse departments to target faculty position requests that will simultaneously serve the larger institutional priorities, increase interdisciplinarity across campus, and fulfill disciplinary needs within departments.

Allocation of faculty positions to support the Biodiversity Initiative is necessary but not sufficient to build institutional distinction in this area. Also needed are human and physical infrastructure elements to facilitate interdisciplinary teaching, scholarship, and outreach. The plan for the Biodiversity Initiative delineates resources required for these purposes.

In the current university plan, UP3, Action Item 60 calls for the integration of the new Berry Biodiversity Conservation Center into the academic mission of UW. In particular, the university is challenged to integrate this physical asset into supporting baccalaureate and graduate degree programs in the life sciences (including the PhD Program in Ecology), to develop public outreach programs, and to identify and support the requisite research facilities for these academic programs.

In her February 2, 2011 charge letter to the biodiversity conservation task force named by President Buchanan to respond to Action Item 60, Vice President Carol Frost charged the group with developing a plan for an interdisciplinary program in biodiversity conservation (Appendix A). This document constitutes the group's response to that charge.

B. Long-range Flexibility and Interdisciplinarity.

The Wyoming Biodiversity Initiative includes a large element of flexibility in execution. Some unique elements (administration, funding programs, outreach programs) are prescribed, but others (specific allocation of faculty positions, allocation of research-incentive funds) are flexible within broad constraints. It is inappropriate at this time to dictate precisely how faculty positions should be allocated among disciplines, departments, or colleges, or where seed grants should be directed. New needs and opportunities will arise as the Initiative proceeds from inception to maturity. The Initiative adopts a model for faculty recruitment that builds on the current CPM process and is similar to that employed by the NSF EPSCoR Program and the School of Energy Resources. The Initiative would provide salary bridge-funding and startup funds as an incentive for departments to compete for positions in the CPM process. In many cases, the CPM request-for-proposals may target specific areas of critical interdisciplinary need and opportunity. The positions will, however, be constrained by the Initiative in two ways. First, requests must be strongly justified in terms of instructional contributions to biodiversity science or biodiversity studies degree programs. Second, all faculty positions will have substantial allocations to interdisciplinary research, teaching, and outreach within the Biodiversity Initiative. Greatest benefits to the University will accrue if many, and perhaps all, of the faculty hired under the Initiative are co-located in a single building dedicated to biodiversity studies.

C. Impact on UW's Mission.

The Wyoming Biodiversity Initiative will enhance the University's national and international stature as a center of integrated research, education, and outreach on biodiversity. It will advance UW's mission in two key areas of distinction, as identified in the 2009 Academic Plan: life sciences, and environment and natural resources. Furthermore, it will integrate these areas with other University strengths, advancing the other four areas of distinction: critical science and technology (via partnerships to develop and apply cutting-edge technologies to biodiversity science and conservation), cultural assets, arts, and humanities (using biodiversity as a compelling theme for study, analysis, valuation, and appreciation), history and culture of the Rocky Mountain region (by the reciprocal link between the region's biodiversity and its cultures), and professions critical to the state and region (by training and continuing education for the substantial workforce involved in biodiversity inventory, management, and policy). The Biodiversity Initiative is uniquely positioned to integrate all six areas of distinction in a specific focus area.

The Biodiversity Initiative will continue to extend UW's ability to recruit outstanding faculty members, not only in the life and environmental sciences but broadly across the campus. It will foster greater interdisciplinarity in research and scholarship, education, and curriculum. It will contribute unique outreach programs to a wide variety of stakeholders across the state and region, and at national and international levels.

APPENDIX A. TASK FORCE CHARGE LETTER FROM VP CAROL FROST:

UNIVERSITY
OF WYOMING

Office of the President
Dept. 3434, 1000 E University Avenue
Laramie, WY 82071

Carol D. Frost, Vice President of Special Projects
(307) 766-4121 • fax: (307) 766-4126
206 Old Main • Frost@uwyo.edu

To: **Ed Barbier, Craig Benkman, Greg Brown, Ingrid Burke, Dan Doak, Jake Goheen, Kristina Hufford, Steve Jackson, Bill Lauenroth, Carlos Martinez del Rio**

From: **Carol Frost**

Subject: **Initial Biodiversity Conservation program development**

Date: **2 February 2011**

Copies: **Tom Buchanan, Myron Allen, Bill Gern, Oliver Walter, Frank Galey, Brent Hathaway**

UP3 recognizes UW's long-standing expertise in life and environmental sciences and natural resources. The new Berry Biodiversity Conservation Center bolsters these areas of distinction, providing a home for faculty, visiting scholars, and graduate students in the Program in Ecology and other life science graduate programs. Several core research facilities and the Wyoming Natural Diversity Database also located in the Berry Center support the study and conservation of biodiversity.

New facilities offer opportunities to nucleate and grow excellence in areas of importance to the state, region, and beyond. The new Berry building can become a focal point around which UW may develop a strong interdisciplinary program in the field of biodiversity conservation. Done well, such a program could attract significant additional funding to enable further growth. I thank you for accepting the challenge to help develop a vision and plan for a UW program in the broad field of Biodiversity Conservation. Specifically, I ask that you initiate:

A Vision for the Biodiversity Conservation program. Start the process of developing a program by identifying UW's focus areas within biodiversity conservation. Some elements to consider incorporating in such a program are described briefly at the end of this memo.

1. ***Convene a workshop this spring*** attended by experts both on and off campus that would address: 1) UW's strengths and assets, 2) the critical issues in the field, now and in the future, and 3) areas of unmet need. The intersection of these themes may identify the area(s) where UW can make the most significant impact.

2. ***Develop a draft plan for an interdisciplinary program*** in Biodiversity Conservation, seeking input from representatives of a broad spectrum of related programs and units at UW, including:
    - Wyoming Natural Diversity Database
    - Wyoming EPSCoR
    - WYGISC
    - Wyoming Fisheries and Wildlife Cooperative Study Unit
    - Haub School of Environment and Natural Resources
    - Ruckelshaus Institute of Environment and Natural Resources
    - Shlemon Center for Quaternary Studies
    - Program in Ecology

- Water Resources Data System and Wyoming State Climate Office
- UW/NPS Research Center
- Rocky Mountain Herbarium
- UW Entomology Museum
- School of Energy Resources
- Wyoming Reclamation and Restoration Center
- Faculty with interests in life sciences, natural resource economics, climate change, paleontology, Earth sciences, and anthropology. Also consider faculty in history, art, and literature of ecology and conservation, sociology, philosophy, political science and others.

I would like you to include in the plan two elements that will establish immediate public awareness of UW's accomplishments in biodiversity conservation:

1. a strategy for developing a strong web presence for UW's biodiversity and conservation-related activities, and

2. an outreach program that involves the public in learning (sometimes referred to as "citizen science") and communicates scientific information to the public. Plan some initial, high-impact outreach activities that will draw attention to the Berry Biodiversity Conservation Center, such as a speakers program and activities for in-person and on-line visitors.

Timeline and logistics. I will call an initial meeting of the a group to discuss the committee's charge, which I ask you to complete by August 15, 2011. I have asked Steve Jackson to serve as committee chair. I will serve as your main liaison with UW upper administration, and you may contact me at any time. I would also like you to meet periodically with me, Provost Myron Allen and Vice President Gern to update us on your progress. Because the field of biodiversity conservation is broad in scope and diverse in terms of entities involved, audience served, and the research it supports, there may be a need for a collaborative or consensus-building process to facilitate discussion and planning, particularly in developing a vision and goals for a UW program. Therefore the committee may discuss whether to engage a facilitator to assist with this task.

Budget. I will ask the committee chair to develop a budget for the committee's spring semester activities. Funds will be allocated from unexpended Berry Center construction monies.

Scope. The biological diversity of our planet is the result of billions of years of evolution, shaped by natural processes and more recently by the activity of humans. It forms the web of life of which we are an integral part and upon which we depend. ***Biodiversity Science*** is more than just biological science because it includes the *impacts* of human activities on biological diversity. ***Conservation Biology***, which seeks to protect species, habitats, and ecosystems, involves engaging the public and determining the best actions to preserve planet health. We can describe the discipline of ***Biodiversity Conservation*** as composed of several areas:

1. Biodiversity science *sensu stricto*, including:

- the plant, animal, and microorganism species on Earth,
- the genetic differences within species, and
- the ecosystems in which living creatures interact with one another and with air, water and soil,
- the factors governing the abundance and distribution of species, and
- assessment of threats to biodiversity by natural processes and by human activities.
- An understanding of uncertainty is also an important element of biodiversity science.

2. Valuation of biodiversity, including:

- ecological and/or ecosystem services, including benefits in the form of raw materials, purification of air and water, decomposition of wastes, recycling of nutrients, and regulation of climate,
- medical, recreational, and tourism value,
- scientific and educational value,
- aesthetic value, and
- spiritual value, a sense of place.

3. Effective communication of biodiversity conservation science, including:

- communication of scientific information to a variety of stakeholders and decision-makers,
- recognition that aspects of biodiversity conservation can be explored and expressed by experts in a wide range of fields beyond life sciences and natural resource economics, including fine arts (particularly through portrayal of the natural world), literature (including writings about nature and conservation), history (for example history of the conservation movement), philosophy and ethics, sociology, political science, and so forth, and
- understanding the context in which scientific information is received and used, including recognition of multiple claims on resources based upon competing sociopolitical, cultural and economic values, and the necessity of weighing values and making tradeoffs.

4. Other aspects of biodiversity science and conservation biology as identified by the committee.

Structural elements. Develop a plan for an interdisciplinary program in biodiversity conservation that describes its missions in terms of education, research and outreach. It may be helpful to review various existing models for interdisciplinary programs at other universities as well as the initial plan for UW's School of Energy Resources. Consider what can develop at UW that, as Jaroslav Pelikan put it, capitalizes on "a unique opportunity to make a concrete difference in the profession, and through it in the society."

APPENDIX B. TASK FORCE COMPOSITION

Task Force Members:

Stephen T. Jackson, Chair (Professor of Botany; Director of the Program in Ecology)

Edward B. Barbier (John S. Bugas Professor Economics)

Gregory K. Brown (Professor of Botany; Acting Director of the Berry Center)

Ingrid C. Burke (Director of the Haub School and Ruckelshaus Institute of Environment and Natural Resources; Professor of Botany and Renewable Resources)

Roger H. Coupal (Associate Professor of Agricultural and Applied Economics)

Paul V.M. Flesher (Associate Professor and Director of Religious Studies)

Jake Goheen (Assistant Professor of Zoology & Physiology)

Kristina M. Hufford (Assistant Professor of Renewable Resources; School of Energy Resources)

William K. Lauenroth (Professor of Botany)

Carlos Martinez del Rio (Professor of Zoology & Physiology)

Deborah D. Paulson (Associate Professor of Geography)

Carol Frost (*ex officio*; Vice President for Special Projects; Professor of Geology & Geophysics)

APPENDIX C. PROCESS FOR DEVELOPMENT OF THIS REPORT

Timeline. The Task Force was appointed 2 February, 2011, by Vice President Carol Frost. Task Force members met on 9 February with President Tom Buchanan, Provost Myron Allen, and Vice Presidents Bill Gern and Carol Frost to discuss the Task Force charge and context. The Task Force had two one-hour organizational meetings (25 February and 4 March), followed by two 5-hour information-gathering meetings (10 and 24 March), described in detail below. The Task Force had 5 additional meetings on 6 April (2 hours), 16 April (8 hrs), 2 May (5 hrs), 1 June (5 hrs), and 5 July (5.5 hrs). Task force members also met in subgroups and working groups in April and May to discuss ideas, develop plans for various components, and draft text for the report. Task Force members sought ideas and advice from a number of colleagues across campus in April and May. Report assembly and writing commenced in early June. Three successive drafts of the Task Force report were reviewed, discussed, and revised by Task Force members. The final report was completed 12 July, 2011.

UW Experts. The first part of each information-gathering meeting (10 and 24 March) was devoted to 15-minute presentations and discussions with some 20 UW faculty and staff (listed below), with the aim of identifying key resources and potential partnerships. After the presentations and discussions, the Task Force members went into closed session for 90 minutes to discuss the presentations and other issues.

External Advisors. In late February, the Task Force identified seven national and international leaders in the field of biodiversity science and conservation, and consulted with each individually either via campus visits (Millar, Wiens), videoconference (Collins, Crane, Gaines, Mace), or teleconference (Raven). At least two Task Force members attended each conference, including Chair Jackson, who attended all interviews. Meetings ranged from one to two hours. The advisors were asked to identify the most important challenges in biodiversity science and conservation, discuss the emerging opportunities, and comment on how UW might develop a unique niche in this area. All responded enthusiastically and were generous with their time, ideas, and advice. Summaries of the discussions were vetted by attendees and distributed to all Task Force members. In addition, the Task Force drew on a January visit by four members (Barbier, Brown, Jackson, Lauenroth) to Cornell University, where they toured the Cornell Laboratory of Ornithology and met with its Director (Fitzpatrick). They also met with the Director of Cornell's Atkinson Center for a Sustainable Future (DiSalvo). Summary notes from that visit were distributed to all Task Force members.

Facilitation Team. In order to ensure an efficient and inclusive process, Chair Jackson and Vice President Frost considered engaging a facilitation team at the outset of the Task Force. In late February they contacted CDR Associates in Boulder, Colorado, an internationally recognized firm specializing in facilitation and mediation. Two CDR staff members, Mary Margaret Golten and Andrea Meneghel, were engaged as facilitators to provide expertise in collaborative decision-making, consensus-building, and conflict resolution and to help the Task Force use its time and resources most efficiently. All Task Force meetings after 10 March were facilitated by one or both of the CDR staffers, who played an invaluable role in bringing the Task Force activities to a smooth and successful conclusion.

Participating UW Faculty (asterisk denotes a formal presentation to the Task Force; others were consulted in individual or group discussions and emails):

Gary Beauvais* (Wyoming Natural Diversity Database (WyNDD))
Craig Benkman (Zoology & Physiology)
Michael Brown* (Communications & Journalism)
Matt Carling* (Zoology & Physiology; Berry Center Vertebrate Collections)
Mark Clementz* (Geology & Geophysics; Geology Museum)
Deborah Donahue (College of Law)
Dan Doak (Zoology & Physiology)
Teena Gabrielson* (Political Science)
Steve Gray* (State Climatology Office; Water Resources Data Service; Civil & Architectural Engineering)
Jeff Hamerlinck* (Wyoming Geographic Information Sciences Center (WyGISC))
Ron Hartman* (Botany; Rocky Mountain Herbarium)
Margaret Haydon* (Art)
Harvey Hix* (English; Master of Fine Arts Program)
Matt Kauffman* (USGS Wildlife and Fish Cooperative Unit; Zoology & Physiology)
Ricki Klages* (Art)
Amy Krist (Zoology & Physiology)
Jeff Lockwood* (Philosophy; Creative Writing)
Mark Lyford (Life Sciences Program)
Richard Machalek (Sociology)
Susan Moldenhauer* (Art Museum)
Sylvia Parker (Science and Mathematics Teaching Center)
Scott Shaw* (Renewable Resources; Insect Museum)
Pete Stahl* (Renewable Resources; Center for Reclamation & Restoration)
Sarah Strauss* (Anthropology)
John Tschirhart* (Economics & Finance)
Naomi Ward* (Molecular Biology)
David Williams (Renewable Resources; Stable Isotope Facility)

External advisors:

Jim Collins (Ullman Professor of Natural History and Environment, Arizona State University)
Sir Peter Crane (FRS, NAS) (Dean, Yale College of Forestry and Environment)
Frank DiSalvo (NAS) (Director, Atkinson Center for a Sustainable Future, Cornell University)
John Fitzpatrick (Director, Cornell Lab of Ornithology)
Steve Gaines (Director, Bren School of the Environment, University of California – Santa Barbara)
Georgina Mace, CBE (FRS) (Director, Centre for Population Biology, Imperial College London)
Connie Millar (Research Scientist, U.S. Forest Service)
Peter Raven (NAS) (Director Emeritus, Missouri Botanical Garden)
John Wiens (Chief Conservation Science Officer, Point Reyes Bird Observatory)

CBE: Commander of the Order of the British Empire
FRS: Fellow of the Royal Society of London
NAS: Member of the U.S. National Academy of Sciences

APPENDIX D. UNIVERSITY ASSETS RELEVANT TO THE INITIATIVE

The Wyoming State Science and Technology Plan states that "a high priority is to focus Wyoming's research and development in areas in which Wyoming has strength and in which additional investment will provide the critical advantage." The University of Wyoming has a long history of strength in biodiversity scholarship, with new capabilities provided by the Berry Center. It has significant assets in biodiversity-related research, education, and outreach, including existing faculty expertise and curricula. These assets furnish a solid foundation on which to develop national to international distinction in biodiversity-related research, education, and outreach. Rather than competing with these assets, the WyBI will work with them. WyBI will help to make connections among them, improve cooperation, and provide opportunities for resources to enhance their activities. The Initiative will build on UW's record of effective planning and allocation of faculty resources to strengthen its areas of distinction (including "life sciences" and "environment and natural resources").

Existing Assets:

The University of Wyoming has a long-standing tradition of excellence in research and education in ecology, the earth and environmental sciences, environmental and natural-resource economics, and other areas at the core of biodiversity science and conservation. Expertise is distributed widely among departments and colleges, and several departments have concentrations of faculty with national to international distinction in these areas. In the past several years, the University has consolidated these strengths in several cross-cutting programs and initiatives. Given the breadth of the Biodiversity Initiative, a broad swath of the academic component of the University can contribute to and benefit from the Initiative. Current assets include:

- **Robert and Carol Berry Biodiversity Conservation Center.** The Berry Center opened in January 2011, and provides a locus for many activities related to biodiversity science and conservation, including teaching, research, and outreach. The building currently houses offices and facilities for the Program in Ecology, Wyoming Natural Diversity Database, Stable Isotope Facility, Nucleic Acids Exploration Facility, the UW Vertebrate Collections, and the Berry Center outreach and education program.

- **Program in Ecology (PiE).** The doctoral Program in Ecology was launched in 2005, drawing from faculty expertise across campus. The Program has grown rapidly to become the University's largest PhD-granting entity (currently 48 students). The Program currently has 39 faculty from 9 departments, and 17 affiliate faculty from four additional academic departments as well as state and federal agencies and NGOs. It is becoming recognized as one of the top ecology doctoral programs in the nation.

- **Ruckelshaus Institute of Environment and Natural Resources.** The Ruckelshaus Institute conducts interdisciplinary research and outreach to inform decision-making on important issues in environment and natural resources. It also provides collaborative decision-making support in these areas. The Institute serves a broad community, including state and federal agencies, non-governmental organizations, private industry, and consulting firms.

- **Wyoming Fisheries and Wildlife Cooperative Study Unit**. Jointly sponsored by UW, the U.S. Geological Survey, U.S. Fish and Wildlife Service, and the Wyoming Department of Game and Fish, the Unit conducts research on natural resource issues, educates students in the field of natural resources, and provides technical assistance to a variety of stakeholders, including state and federal agencies and

NGOs. Graduate students are jointly trained in the science of ecology and the practice of conservation and management.

- **Wyoming Natural Diversity Database (WyNDD).** WyNDD, located in the Berry Center, is Wyoming's representative in the North American Natural Heritage Network. It maintains a statewide database on rare plants and animals as well as an inventory of plant communities and habitats. It serves state, tribal, and federal agencies, consulting companies, non-profit organizations, landowners, and academic and independent researchers.

- **Rocky Mountain Herbarium.** Founded in 1894, the Herbarium has the world's largest collection of plant specimens from the Rocky Mountain region. With more than 1.2 million specimens, it is ranked tenth nationally among all herbaria, and is the third-largest university herbarium in the nation. The Herbarium sponsors an active floristic inventory program spanning the Rocky Mountain region, and is a leader in identifying species of conservation concern.

- **Insect Museum.** The UW Insect Museum is the only entomology research collection in Wyoming, and contains more than a million specimens. The collections and staff offer expertise for insect identification and inventory and provide a critical resource supporting UW extension programs. The collection contains numerous recently identified species from Wyoming that are new to science.

- **UW Vertebrate Collections.** These collections, newly housed in the Berry Center, contain more than 10,000 specimens of mammals, birds, fish, and other vertebrates, with collection localities concentrated in Wyoming. The collection has ample storage space for expansion and is about to launch a major collecting effort. It plans to develop the largest collection of Rocky Mountain birds in the world.

- **Wyoming Reclamation and Restoration Center.** The Center's primary focus is on assisting energy companies and regulatory agencies in mitigating ecological and environmental impacts of energy extraction. The Center works closely with UW's School of Energy Resources, and has identified biodiversity as a central priority in land reclamation and ecological restoration.

- **Wyoming Geographic Information Sciences Center (WyGISC).** WyGISC is focused on research, education, and outreach related to geospatial information development, access, and use. Particular strengths include data services, remote sensing, geographic visualization, spatial modeling, and decision support. It has a staff position dedicated to ecological informatics, a rapidly expanding field that plays important roles in biodiversity science.

- **Nucleic Acid Exploration Facility (NAEF).** The NAEF is a core research facility, located in the Berry Center, dedicated to low-cost genotyping and DNA sequencing, and student training in molecular methods. Molecular tools play a central role in biodiversity science.

- **Stable Isotope Facility (SIF).** The SIF is a core research facility in the Berry Center that provides isotopic analyses for research and student training in isotopic methods and markers. Stable isotope analysis is an increasingly important tool in biodiversity science.

- **Geology Museum.** UW's Geology Museum, established in 1887, exhibits and interprets material relevant to Wyoming's geologic history, fossil record, and research by UW Earth scientists. Exhibits emphasize evolution, ecology, and extinction as reflected in the fossil record, and thus the Museum has a strong biodiversity focus. More than 10,000 visitors passed through in the past year.

- **University of Wyoming – National Park Service Research Center.** The Center fosters research in the National Parks of the Rocky Mountain region. It operates a seasonal field research station at the

AMK Ranch in Grand Teton National Park. The Center and the AMK Ranch have respectively supported numerous biodiversity studies in the region.

- **Haub School of Environment and Natural Resources.** The Haub School supports interdisciplinary undergraduate and graduate degree programs in environment and natural resources, in collaboration with departments and colleges across the UW campus. Students receive training in collaboration, multi-perspective analysis, and policy issues, as well as depth in disciplinary fields.

- **Archival Assets.** The **University Libraries** are investing in digital technologies to archive a variety of entities and images, and are collaborating with the Rocky Mountain Herbarium in an innovative program to archive digital images of plant specimens. Collections at the **American Heritage Center** include historical photographs and documents that constitute invaluable resources for assessing changes in Wyoming's landscapes.

- **Life Sciences Program.** The Life Sciences Program coordinates the design and delivery of courses in the life sciences that cut across the many life-science departments at UW. The curriculum provides life-science majors with breadth and depth in the basic life sciences, and non-science majors with exposure to key concepts in biology and an understanding of the connections between science and society.

- **UW Extension Service.** The Extension Service provides considerable expertise and assistance to landowners and land managers in state of the art natural resource management in the State. A portion of the program is involved in outreach of ecological sciences and ecological economics to citizens in the state and region.

- **Outreach School**. The UW Outreach School extends the University's educational programs to the people of the state of Wyoming and beyond with distance-learning programs for people of many ages, interests, locations, and motivations.

- **Science and Mathematics Teaching Center (SMTC).** SMTC has a long history of effective partnership with K-12 educators and schools throughout the state and region. It has been involved in several activities related to ecology, natural resources, and the environment.

- **Departmental and College Assets.** The University has faculty across campus with interests in issues surrounding biodiversity and its conservation. The following summation is intended to be representative, not exhaustive, and summarizes assets in supra-disciplines.

    - ***Life Sciences.*** UW has considerable strength in the Life Sciences, with approximately half the faculty strength working in areas related to biodiversity (ecology, evolution, systematics). Biodiversity strengths are concentrated in Botany, Zoology & Physiology, Molecular Biology, and Renewable Resources, but several other departments have individual or small clusters of faculty working in relevant areas.
    - ***Physical Sciences.*** Faculty members in Geology & Geophysics and Atmospheric Sciences are working directly in biodiversity-related areas. Both departments are partnering with life-science departments to hire joint faculty in land-surface/atmosphere interactions and paleobotany.
    - ***Social Sciences.*** UW has diverse strengths in Anthropology, Geography, Political Science, Law, History, and Psychology. Several current faculty members are active in biodiversity-related research and are eager to participate in the Initiative.
    - ***Environmental and Resource Economics.*** UW's Department of Economics and Finance has an internationally recognized group of environmental and natural-resource economists, and is ranked at the top nationally in research and scholarship. The Department of Agricultural and Applied Economics also has faculty strength and experience in biodiversity and conservation.

- ***Humanities.*** As a liberal arts institution, the University has a full array of humanities departments (Philosophy, English, Modern and Classical Languages) and programs (e.g., Religious Studies, American Studies). Many faculty members in these are working in various aspects of biodiversity studies.
- ***Visual and Performing Arts.*** The University's College of Arts and Sciences has several departments dedicated to the arts, including Art, Music, and Theatre and Dance. Faculty within these departments have been involved in artistic representations drawing from biodiversity. The University Art Museum has sponsored several exhibitions with biodiversity and related themes.
- ***Communication Arts.*** UW's Department of Communication and Journalism has diverse strengths in information delivery and dialogue with the public. The Creative Writing Program and diverse elements of UW's English Department provides complementary strength. Several Creative Writing faculty members are involved in writing on biodiversity themes.
- ***Engineering and Technology.*** UW's College of Engineering and Applied Science has diverse strengths. Expertise in electrical, mechanical, and chemical engineering has potential to contribute to the development of new tools and technologies for biodiversity assessment.
- ***Computational Sciences.*** Biodiversity science draws increasingly on computational capabilities for modeling, data management, and analysis. The University's strengths in computational sciences (Mathematics, Statistics, Computer Sciences), and its association with the UW/NCAR SuperComputing Facility, provide valuable resources and opportunities for collaboration.
- ***Education.*** The College of Education offers opportunities for partnering with the Biodiversity Initiative to provide training to K-12 teachers and develop hands-on experiences for K-12 students across the state and region.