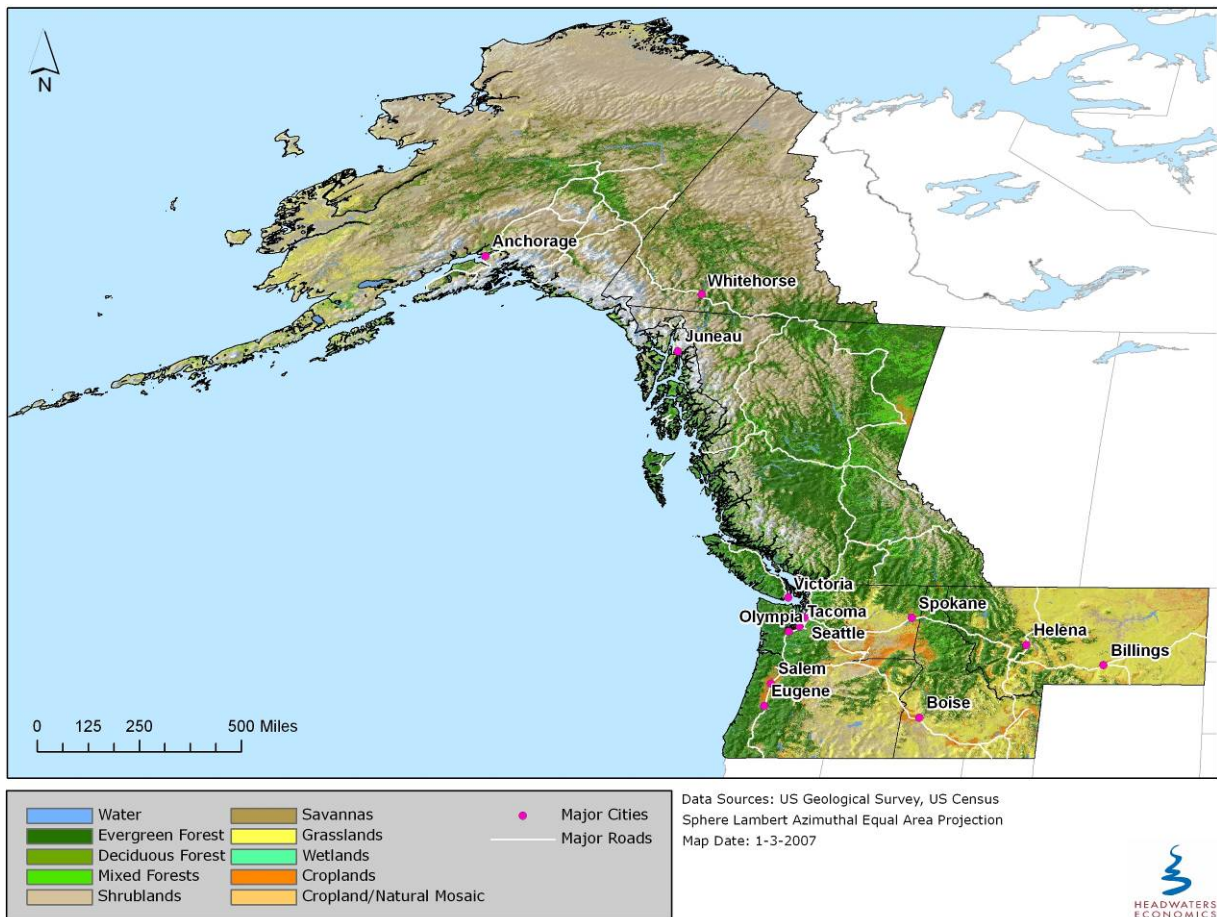


CONSERVATION ATLAS OF THE NORTHWEST

ECOLOGICAL, ECONOMIC AND DEMOGRAPHIC CONDITIONS, HUMAN ACTIVITIES AND OPPORTUNITIES FOR CONSERVATION



PRODUCED BY
HEADWATERS ECONOMICS
FOR THE BRAINERD FOUNDATION

JANUARY 2007

ABOUT THE BRAINERD FOUNDATION

The Brainerd Foundation protects the environmental quality of the Northwest and builds broad citizen support for environmental protection. It makes grants, provides guidance, leverages funding and encourages collaboration within the philanthropic community.

The mission of the Brainerd Foundation is to protect the environmental quality of the Northwest and to build broad citizen support for conservation.

Washington, Oregon, Idaho, Montana, Alaska, British Columbia and the Yukon Territory constitute the foundation's geographic funding region.

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ABOUT HEADWATERS ECONOMICS

Headwaters Economics is a nonprofit social science research and conservation organization that offers a unique blend of research skills and on-the-ground conservation experience based on over 20 years of work with communities, landowners, public land managers and elected officials across the West.

The mission of Headwaters Economics is to improve community development and land management decisions in the West by producing and distributing credible information on linkages between economics and the environment.

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THE BRAINERD FOUNDATION'S NEW DIRECTION

Paul and Sherry Brainerd grew up in the Pacific Northwest and believe people here share a special attachment to their wildlife, land and water. Time and again, the people of the Northwest have taken extraordinary steps to make sure those natural resources are used wisely and passed on to future generations. The Brainerd Foundation exists to help communities in that task.

The job of the Brainerd Foundation is to protect the environmental quality for the people of the Northwest and to help local communities reach their conservation goals. The foundation recently developed a new strategic plan to guide its work. This *Atlas* was one resource consulted by the foundation in charting its new path.

The foundation understands the importance of funding organizations that provide long-standing leadership and vision on conservation issues; it also seeks new groups and innovative strategies to advance an ethic that cherishes the community and the land.

The foundation has three main program areas: conservation policy, place-based conservation, and conservation capacity. The *Conservation Atlas of the Northwest* is intended principally to inform the second of these – place-based conservation support.

This analysis helped identify local landscapes where investments will be made for the foundation's Placed-Based Conservation Program. It is also designed to serve as an up-to-date resource for other foundations and grantees looking to be effective and efficient in their work to conserve treasured natural resources of the Northwest.

THE OBJECTIVES OF THIS ANALYSIS

Like everyone else, the Brainerd Foundation has limited resources and must live within a budget. While always wishing it could do more, the foundation must focus its investments to ensure it is making wise choices.

The *Conservation Atlas of the Northwest* is intended to help the Brainerd Foundation identify areas with high ecological importance, regions where the pace and scale of human development pose significant challenges to the natural environment, and places where there are encouraging opportunities to conserve natural resources.

The intent of the research is also to inform the grantmaking priorities of the Brainerd Foundation in Oregon, Washington, Idaho, Montana, Alaska, British Columbia and the Yukon Territory; the grantmaking of other Northwest philanthropies; and the work of conservation groups and community partners.

While Headwaters Economics, along with other consultants, provided information to the Brainerd Foundation to aid in making decisions about how and where to implement its new direction, it was the foundation's responsibility to select specific geographies for grantmaking.

METHODS

Headwater Economics' methodology for this project is as follows:

1. Define Scope

With guidance from the Brainerd Foundation staff and board, we defined the geographic and substantive scope of the *Atlas*. The geographic extent is consistent with the foundation's grantmaking region and the substance focuses on ecological values, human activities and opportunities for conservation.

2. Gather Data

We then gathered ecological, geological, economic, demographic, land use and political data for Oregon, Washington, Idaho, Montana, Alaska, British Columbia and the Yukon Territory. We made every effort to ensure that data came from credible sources and scientists who used sound peer-reviewed methods.

3. Organize Data

We organized the information into broad categories: land cover, land ownership, ecological conditions, human activities, economic and demographic typologies, and politics. Within each major category, we further organized information into sub-categories.

4. Analyze Relationships

We then compiled indices of related data to show areas of high natural values, and regions with significant or potentially significant human activities.

5. Produce Maps

We produced high-resolution maps of all the gathered and analyzed data.

6. Post to Web

All *Atlas* maps can be found on the Web at: www.headwaterseconomics.org/nwatlas.

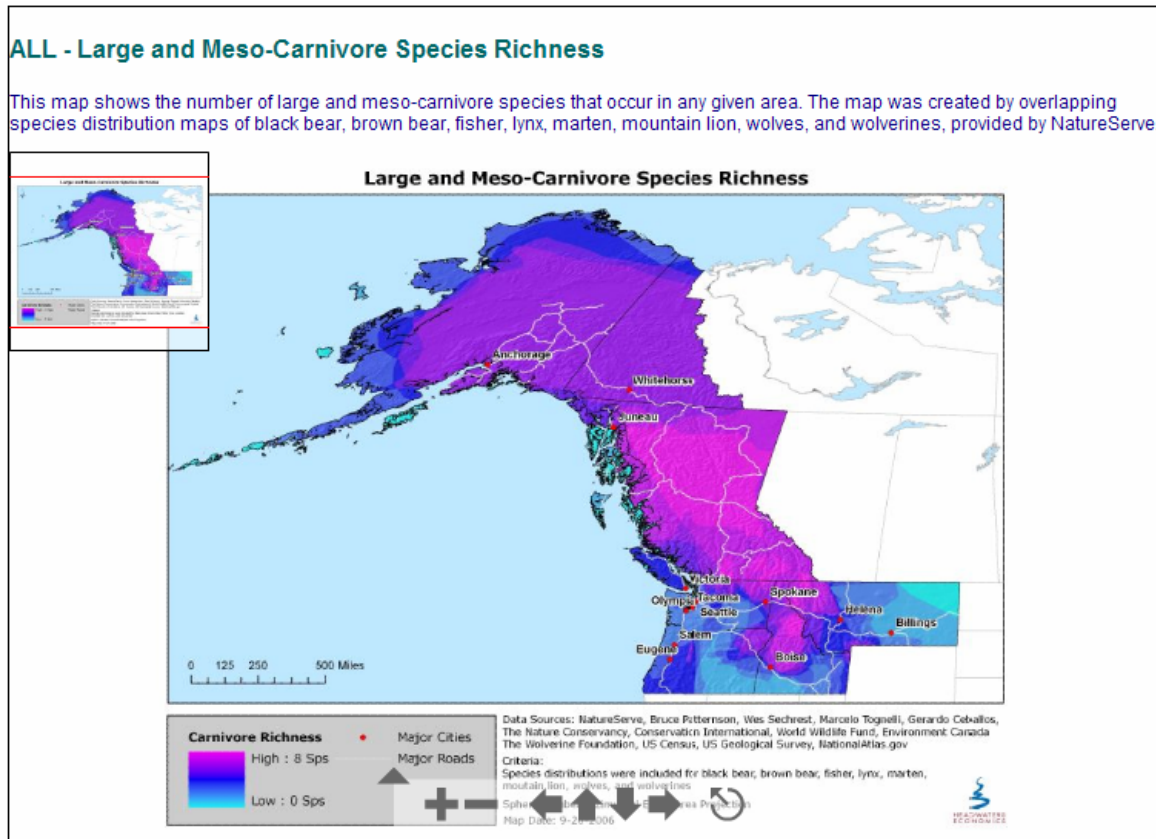
7. Present Findings

Headwaters Economics staff presented findings to the Brainerd Foundation, which used the information to select priority geographies for long-term grantmaking.

SAMPLE MAP

This section shows a sample map from the *Atlas* web site.

Each map is accompanied by a listing of the original data sources and the criteria scientists or groups used in their analysis. Each map also has a link to Metadata, which consists of technical documentation that describes the data, methods, sources and their contact information.



[Meta Data Documentation](#)
[na_carnivore.txt](#)

[Index](#)

[Introduction](#) | [Keyword Search](#)

In the map above, for example, a range of scientists and organizations used the species distributions of black bear, brown bear, fisher, lynx, marten, mountain lion, wolves, and wolverines to determine carnivore species richness.

Users can view maps in more detail by selecting the navigation keys at the bottom of each map. Metadata can be viewed by clicking on the link at the lower left of each map. An index and keyword search function are also available to navigate to other maps.

LIST OF MAPS

All *Atlas* maps are listed in tables at the end of this report. Some maps cover the entire Northwest geography, while others show only Alaska, western Canada or mainland northwest states in the U.S.

Each map is preceded with an abbreviation that indicates its geographic extent:

- All = Northwest Region
- US = Idaho, Montana, Oregon, Washington
- AK = Alaska
- CN = British Columbia, Yukon Territory

We produced maps at different scales for a number of reasons. Sometimes data was limited in scope. More often, data was available for the full geography, but we produced smaller scale maps in order to maintain high resolution and make viewing easier.

The image below shows the various ways maps can be found on the web site:

To find a map:

www.headwaterseconomics.org/nwatlas

The screenshot shows the website interface for the Conservation Atlas of the Northwest. On the left is a navigation menu with expandable sections. On the right is the main content area featuring a map of the Northwest and introductory text.

Navigation Callouts:

- Search by keyword:** Points to the search bar at the top of the navigation menu.
- OR**
- 'Expand All Menus' to see complete list; use scroll bar to view all:** Points to the '+ Expand All Menus' button.
- OR**
- Click on each link to view the maps in that category:** Points to individual category links like 'Reference', 'Ecological Conditions', etc.
- OR**
- Click here to see an 'Index' table listing all maps:** Points to the '+ Expand All Menus' button.

Main Content Area:

Conservation Atlas of the Northwest
 Ecological, Economic, and Demographic Conditions,
 Human Activities and Opportunities for Conservation

Produced by Headwaters Economics for the Brainerd Foundation

The Brainerd Foundation hired Headwaters Economics to produce the *Conservation Atlas of the Northwest*. The *Atlas* shows areas with high ecological importance, regions where the pace and scale of human put pressure on natural resources, and places where there are encouraging opportunities to conserve important natural resources. The primary purpose of the *Atlas* is to help the Brainerd Foundation select where they will make future conservation investments. Please contact the Brainerd Foundation for more information on their grant making: www.brainerd.org.

For more information, download [The Executive Summary \(pdf file\)](#).

Map Viewing Instructions

There are four ways to view the maps:

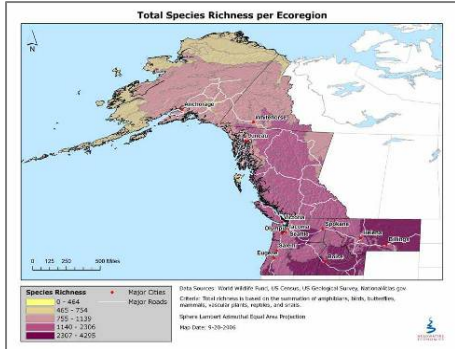
1. Click on a map link at left.
2. [View an index of all Atlas maps.](#)
3. [Search for a map by keyword.](#)
4. Select navigation buttons below each map.

Once the map loads, you will see buttons at the bottom that allow you to zoom in and out, and to move around the map. There are navigation buttons below the maps to view the maps in sequence. These pages were formatted

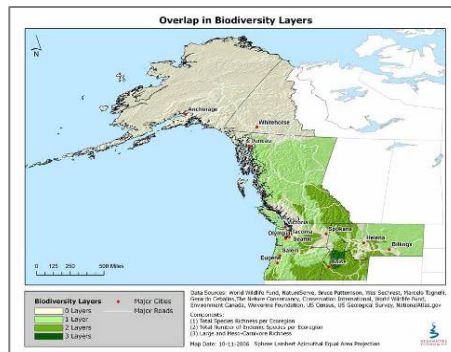
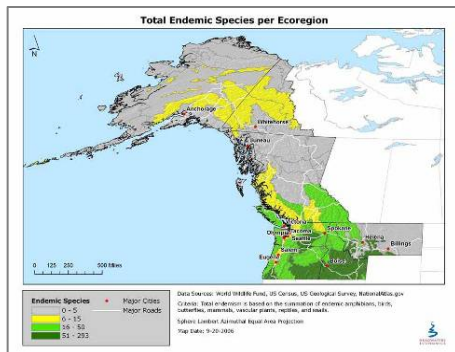
SELECTING GEOGRAPHIES

Our first step in assisting the foundation to select future priority landscapes was to identify places that are rich in rare and highly valued natural resources. We describe this process below. Following the ecological analysis, we produced information to help the Brainerd Foundation identify places where the pace and scale of human activities put pressure on natural resources, and places where there are encouraging opportunities to conserve natural resources.

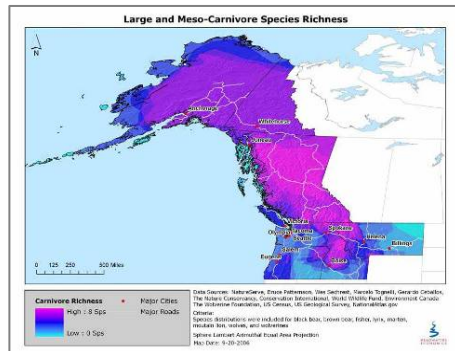
Ecologically important places



We determined ecological importance by viewing all the ecological analysis maps. This resulted in an almost overwhelming amount of information, with numerous criteria pointing to different potential focal areas. For example, one area may be high in biological diversity but insignificant as a migratory route, while another may be critical as a wildlife corridor, but have low biological diversity.



To help resolve this problem, we produced composite maps that combine the analyses from ecologists and conservation groups.

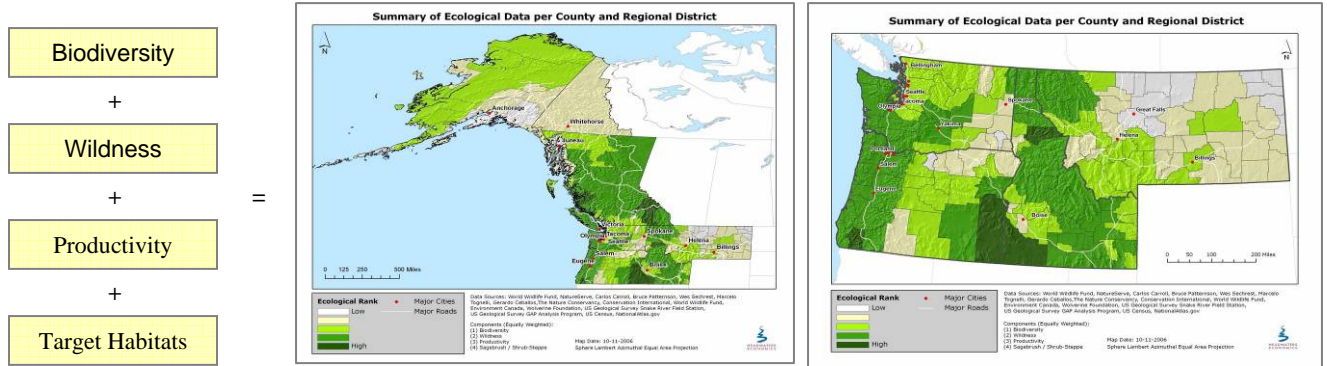


For example, the three maps in the left column are based on different measures of biological diversity: species richness, endemism, and carnivore richness. The fourth map, above, is the result of adding these three together. This composite biological diversity map shows a more comprehensive biological diversity score. The darker the green, the greater the biological diversity.

We created composite maps for several variables covering the entire region. These include: Ecoregional Assessment, Wilderness, Biodiversity, Target Habitats, and Productivity.

We also produced maps of other important criteria for which data was not available for the foundation's entire grantmaking region. These include estimates of potential habitat for rare wildlife species, as well as potential wildlife migration routes.

Finally, we produced combined composite indices by adding together the composite maps from each major criterion. For example, the images below illustrate how four ecological criteria were added to together to produce a composite map. The darker the color, the higher the ecological score.

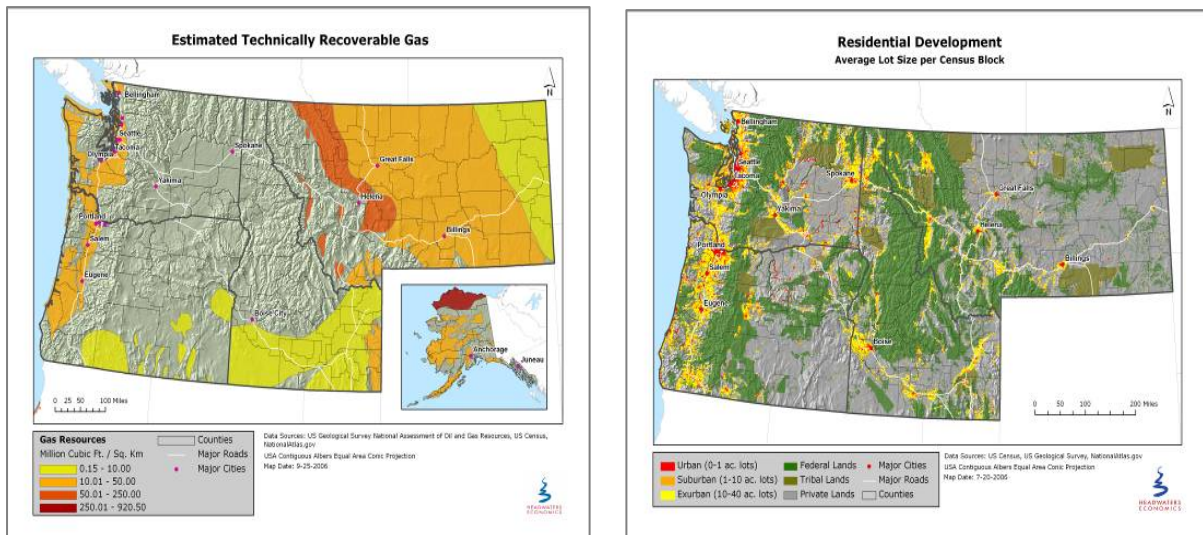


For these combined composites, we show the organized ecological information at the scale of counties (U.S.) and regional districts (Canada), allowing for easy comparison with other maps at the same scale.

Human activities

We produced maps to show various human activities that may impact public land, water and wildlife. These are: exurban development (i.e., sprawl), and resource extraction: oil, gas, coal-bed methane development, plus coal and hard rock minerals mining. We mapped existing development (e.g., currently operating mines), as well as places that in the future may be active (e.g., technically recoverable oil and gas reserves).

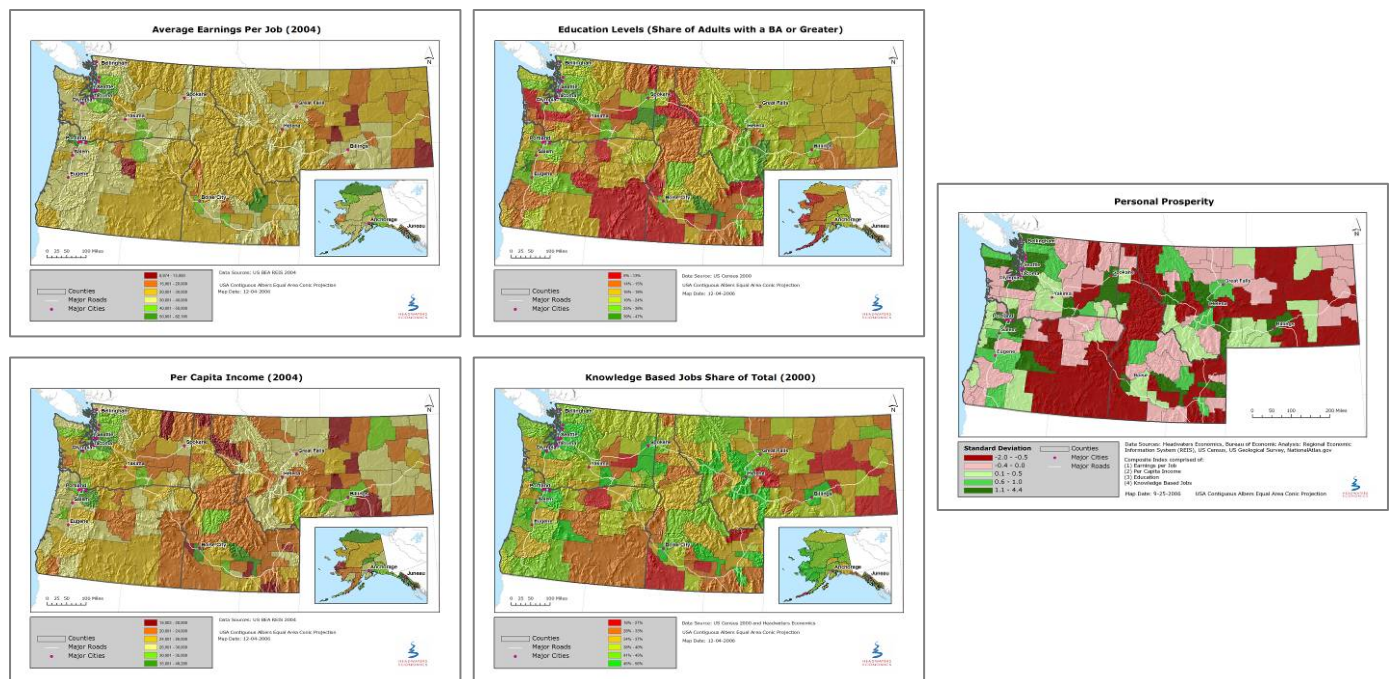
Examples of these types of maps are shown below:



Economic and demographic conditions

We also made maps that show various economic and demographic conditions, as well as access to markets via road and air. We developed economic typologies to characterize the region according to dominant economic features. For example, maps highlight areas that are chronically stressed economically by low wages or lack of jobs, as well as others that are stressed by waves of new migrants who flock to the area for retirement or second homes. Each type of place presents a different conservation challenge and requires tailored approaches.

The maps below illustrate an example: four characteristics (average earnings per job, per capita income, education levels and employment in industries that require college education) combine to form an index, or typology, of personal prosperity (similar maps were produced for Canada).



FINAL SELECTION OF FOCAL AREAS

The Brainerd Foundation combined the information on ecological conditions, human activities, and economic and demographic conditions with information from local communities about opportunities for conservation.

The foundation then made the final selection of areas where it will invest over the long term. To learn more about the grantmaking priorities of the Brainerd Foundation please visit: www.brainerd.org.

ACKNOWLEDGEMENTS

The *Conservation Atlas of the Northwest* was an ambitious project that would not have been possible without the generous assistance – and contribution of data and analysis – of many people and institutions. The Brainerd Foundation and Headwaters Economics would like thank the various individuals and institutions whose scientific analysis on ecological conditions was instrumental for the *Atlas*. They are: Carlos Carroll, Klamath Center for Conservation Research; Chuck Rumsey, Round River Canada; Andy Hansen and Kingsford Jones, Montana State University; Peter Singleton, USDA Forest Service/Pacific Northwest Research Station; American Wildlands; Craighead Environmental Research Institute; NatureServe and its network of Natural Heritage member programs; The Nature Conservancy; Nature Conservancy Canada; Wildlife Conservation Society; World Wildlife Fund; and World Resources Institute.

Joel Clement of the Wilburforce Foundation was instrumental in helping us reach out to the scientific community, and to the various databases collected by CommEnSpace. We thank Chris Davis and his team at CommEnSpace for their assistance, including Jessemine Fung, now with LeeSaa Consulting.

Throughout the project Jessica Hernandez played a key role as a map-maker, researcher, and stalwart addition to the Headwaters Economics team. Other GIS assistance was provided by Chris McGinty and Kent Braddy of Terra Solutions. Headwaters Economics extends a special thanks to ESRI for their generous contribution of GIS software. Without their help this project would not have been possible.

A number of individuals were helpful in providing data as well as insight into the shifting public opinion and political conditions of the region. They are: Suzanne Hawks, Institute for Media, Policy and Civil Society; Cara Pike, Earth Justice; Russell Heath, Southeast Alaska Conservation Council; Steve Thompson, National Parks Conservation Association; Justin Hayes and Susan Drumheller, Idaho Conservation League; Dominick DellaSala, National Center for Conservation Science & Policy; Chris Mehl and Michelle Ackermann, The Wilderness Society; Kim Davitt, America Wildlands; Bonnie Gestring, Earth Works; Bill Marlett, Oregon Natural Desert Association; Ben Long, Resource Media; and Adam Eichberg, Western Conservation Foundation.

Karen Kirby of BC Stats and Myrna Bruns of the Yukon Bureau of Statistics were extremely helpful in providing detailed economic and demographic information for Canada.

Appreciation also goes to the advisory board of the Brainerd Foundation, the members of which – Patricia McCaig, Johnny Mikes, Gordon Orians, Jim Stratton and Brooks Yeager – helped sift through an almost overwhelming amount of information to give us their learned advice.



All = Entire Northwest Region
US = United States (OR, WA, ID & MT)
AK = Alaska
CN = Canada (BC & YK)

[Keyword Search](#)

[+ Expand All Menus](#)
[- Collapse All Menus](#)

Reference

+ Political Boundaries

- US - Counties of Washington, Oregon, Idaho, and Montana
- AK - Borough and Census Areas in Alaska
- CN - Regional Districts of British Columbia and Yukon

+ Land Cover

- ALL - The Northwest
- US - Land Cover
- AK - Land Cover
- CN - Land Cover

+ Land Ownership

- US - Land Ownership
- AK - Land Ownership
- CN - Land Ownership

Ecological Conditions

+ Biodiversity

- ALL - Total Endemic Species per Ecoregion
- ALL - Total Species Richness per Ecoregion
- ALL - Large and Meso-Carnivore Species Richness
- ALL - Overlap in Biodiversity Layers
- US - Overlap in Biodiversity Layers

+ Ecoregional Assessments

- ALL - Biological Distinctiveness per Ecoregion
- ALL - Freshwater Biological Distinctiveness per Ecoregion
- ALL - Overlap in Ecoregional Assessment Layers
- US - Overlap in Ecoregional Assessment Layers

Ecological Conditions (Continued)

+ Productivity

- ALL - Greenness (Productivity)
- ALL - Net Primary Productivity per Ecoregion
- ALL - Overlap in Productivity Layers
- US - Overlap in Productivity Layers

+ Target Habitats

- ALL - Native Landbird Species Richness
- ALL - Sagebrush and Associated Shrub-Steppe Habitat
- US - Sagebrush and Associated Shrub-Steppe Habitat
- US - Estimates of Potential Grizzly Bear Habitat Quality
- US - Estimates of Potential Wolf Habitat Quality

+ Wildlife Corridors

- US - American Wildlands' Potential Migration Corridors: Based on Grizzly Bear Habitat Requirements
- US - Craighead Environmental Research Institute's Potential Migration Corridors: Based on Grizzly Bear Habitat Requirements
- US - Potential Migration Corridors: Based on Large Carnivore Habitat Requirements
- CN - Conservation Area Designs: Muskwa Kechika, Taku, and Coastal Management Areas

+ Wildness

- ALL - "Last of the Wild"
- ALL - Frontier Forests
- ALL - Human Footprint
- ALL - Overlap in Wildness Layers
- US - Overlap in Wildness Layers

+ Summary

- ALL - Summary Using 5 Criteria
- US - Summary Using 5 Criteria
- ALL - Summary Using 4 Criteria
- US - Summary Using 4 Criteria

+ Other Criteria

- ALL - Conservation Site Portfolios per Ecoregion
- US - Native Freshwater Fish Species Richness
- US - Native Freshwater Fish Species Richness: Weighted by Species' Natural Heritage Inventory Global Rank

Human Activities

+ Exurban Development

- US - Residential Development: Average Lot Size per Census Block
- US - Percent Exurban by County: Percent of Private Land Developed at Exurban Housing Densities (10 - 40 acre lots)
- US - Percent Suburban by County: Percent of Private Land Developed at Suburban Housing Densities (1 - 10 acre lots)
- US - Percent Suburban or Exurban by County: Percent of Private Land Developed at Suburban or Exurban Housing Densities (1 - 40 acre lots)
- US - Population Density per County: People per Square Mile of Private Land
- CN - Share of Homes Built in the 1990s

+ Coal

- ALL - Coal Fields
- ALL - Coal Mines Currently in Operation

+ Coalbed Methane

- ALL - Estimated Technically Recoverable Coalbed Methane
- US - Estimated Technically Recoverable Coalbed Methane

+ Oil & Gas Development

- ALL - Estimated Technically Recoverable Gas
- ALL - Estimated Technically Recoverable Oil
- ALL - Oil and Gas Active Well Density
- ALL - Oil and Gas Well Density
- US - Active Oil and Gas Leases on Federal Lands
- US - Estimated Technically Recoverable Gas
- US - Estimated Technically Recoverable Oil

+ Hard Rock Mining

- ALL - Subsurface Gold and Mercury Concurrent Deposits
- ALL - Subsurface Gold Deposits
- ALL - Subsurface Silver Deposits
- ALL - Copper Mines Currently in Operation
- ALL - Gold Mines Currently in Operation
- ALL - Gold, Silver and Copper Mines No Longer in Active Production
- ALL - Silver Mines Currently in Operation
- ALL - Subsurface Copper Deposits
- ALL - Subsurface Diamond Deposits

Politics

+ US Elections

- US - 2004 Presidential Election Results by County
- US - 2004 Presidential Election Results by County: Percent of Votes for George W. Bush
- US - 2004 Presidential Election Results by County: Percent of Votes for John Kerry

+ Canadian Elections

- CN - 2005 Provincial Election Results by Electoral District
- CN - 2005 Provincial Election Results by Electoral District: Percent of Votes for Parties Other Than NDP and LIB
- CN - 2005 Provincial Election Results by Electoral District: Percent of Votes for the Liberal Party
- CN - 2005 Provincial Election Results by Electoral District: Percent of Votes for the New Democratic Party

+ Land Conservation Ballot Measures

- US - Land Conservation Ballot Measures by County
- US - Land Conservation Ballot Measures by Municipality

+ Conservation Groups

- US - Number of Environmental, Conservation, and Wildlife Organizations in 2003

+ Legislative Conservation Voting

- US - National Legislative Scorecard Ratings: House of Representatives
- US - National Legislative Scorecard Ratings: Senate
- US - State Legislative Scorecard Rating by State House District
- US - State Legislative Scorecard Rating by State Senate District

Economic and Demographic Typologies

+ Access to Markets

- US - Access to Large Population Centers
- CN - Major Canadian Airports

+ Agriculture Dependence

- US - Farm Dependency as Share of Personal Income
- CN - Agricultural Dependency Share of Total Employment

(Continued)

+ Amenity Driven Growth

- US - Amenity Driven Growth Index
- US - Annual Population Change from 1990 to 2005 by County
- US - Composition of Population Change 2000-2005: Migration vs. Natural Change
- US - Projected Annual Population Change from 2005 to 2020 by County
- US - Educational Attainment BA or Greater Share of Total
- US - Census Knowledge Based Jobs Share of Total
- US - Personal Income Growth 1990 to 2004 (Annualized Percent Adjusted)
- US - Housing Affordability Index
- US - Proximity to Federal Public Lands Managed for Conservation
- US - Counties with Major Ski Resorts
- US - Variation in Elevation (Mountains & Valleys)
- US - Producer Services Share of Total (2000 Census)
- US - Share of Houses Constructed in the 90's
- CN - Amenity Driven Growth Index
- CN - Annual Population Change per Regional District (1990-2006)
- CN - Composition of Population Change 2001-2005: Migration vs. Natural Change
- CN - Net Migration 5 yr. Average 2001-2005
- CN - Population Growth 1990 to 2005
- CN - Average Income % Chg 96-01 (Annual Rate)
- CN - Projected Annual Population Change per Regional District (2006-2020)
- CN - Ski Lift Capacity
- CN - High Wage Producer Services Share of Total Jobs
- CN - Housing Affordability

+ Economically Stressed

- US - Economic Stress Index
- US - Percent Of Total Personal Income From Welfare Payments
- US - Unemployment Rate In 2004
- US - Share of Total Population with Income Below the Poverty Level (1999)
- US - Age Dependency Ratio (Young + Retired / Working Age)
- US - Age Related Income Share of Total Personal Income

(Continued)

- US - Percent Of Adult Population With Less a Than High School Education
- US - Nonlabor Income Share Of Total (2004)
- CN - Economic Stress Index
- CN - Dependency Ratio (Kids + Retired / Working Age)
- CN - Incidence of Low Income Families in 2000
- CN - Percent of Population with Less than High School Education
- CN - Unemployment Rate

+ Personal Prosperity

- US - Personal Prosperity Index
- US - Average Earnings Per Job (2004)
- US - Per Capita Income (2004)
- US - Educational Attainment BA or Greater Share of Total
- US - Census Knowledge Based Jobs Share of Total
- CN - Personal Prosperity Index
- CN - Share of Jobs Requiring College
- CN - Average Income in 2000
- CN - Education Levels

+ Demography

- US - Annual Population Change from 1990 to 2005 by County
- US - Composition of Population Change 2000-2005: Migration vs. Natural Change
- US - Projected Annual Population Change from 2005 to 2020 by County
- US - Hispanic Population as Share of Total by County
- US - Native American Population as Share of Total by County
- US - Share of Total Population 65 and Older by County
- US - Share of Total Population Under 18 by County
- CN - Annual Population Change per Regional District (1990-2006)
- CN - Composition of Population Change 2001-2005: Migration vs. Natural Change
- CN - Net Migration 5 yr. Average 2001-2005

+ Recreation

- US - Nonmetropolitan Recreation Counties
- CN - Recreation Dependency

+ Resource Dependent

- US - 2003 Share of Employment in Resource Extraction: Forestry, Mining, Fishing, Hunting, Wood and Paper Manufacturing, and Agricultural Support
- CN - Share of Employment in Resource Extraction in 2001