

## Education & Training

*M.S. Ecology, Fisheries and Wildlife, 2000*  
Oregon State University. Collaborated with  
Universidad Nacional Autónoma de México  
(UNAM)

*B.S. Environmental Chemistry (Analytical),  
Bioresource Research, 1994*  
Oregon State University  
*NEPA Training & Writing, 2003*  
The Shipley Group

*Creating Fire-Resilient Landscapes, 2004*  
OSU Forestry, Forest Service, BLM, OFRI  
*Building Ecological Assets, 2005*  
EPRI Solutions

## Languages

*English*, Native Language  
*Spanish*, Professional Fluency

## Experience Highlights

Watershed Analysis & Action Planning

Carbon Sequestration Offset Mechanisms

Climate Change Mitigation, Abatement &  
Working Solutions

Land Use Policy & Restoration Design

GIS Mapping and Analysis

Building Multidisciplinary Teams &  
On-The-Ground Projects and Partnerships

International Focus on Climate Change and  
Ecosystem Services

## Memberships & Certifications

Ecological Society of America  
American Fisheries Society  
American Water Resources Association  
Oregon Winegrowers Association  
SCUBA Open Water Certification

## Contact Information

Watershed Professionals Network (WPN)  
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## CHRIS HEIDER *Ecosystem Ecologist*

### Key Interests

Chris Heider is an ecologist with a background in analytical chemistry specializing in ecosystem-level processes, specifically vegetation mechanisms for carbon offsets, climate change mitigation, water quality, and the effects of land uses and disturbance dynamic on natural resources. Chris has worked throughout the Pacific Northwest (USA), Latin America and the tropical Pacific on focus topics including:

- Quantifying biomass, carbon and nutrient pools/ sequestration rates in a wide range of tropical and temperate ecosystems, including areas of high land use
- Assessment, scale-up and mapping of biomass/ carbon sequestration potentials in land-use designs for a range of prior land uses
- Quantification of atmospheric and ecosystem impacts due to fire use, and mitigation of such uses in land-use planning
- *Ecosystem Services* and modeling the trajectory effects of climate change due to sea level rise, changes in water availability, and development
- Mitigation mechanisms aimed to improve ecosystem connectivity management to enhance water quality
- Use and interpretation of complex models involving fire behavior, hydrology and sediment, and water quality

Chris maintains a professional level of fluency in Spanish, and has an on-call relationship with a diverse group of field-trained professionals throughout the United States, Latin America and the Pacific Islands that provide additional staff requirements, on an as-needed basis.

### Specific Expertise

#### *Biomass, Carbon Sequestration and Nutrient Pool Assessments*

- Current and potential *total ecosystem* carbon & nutrient pools
- Soils and Sediment Flow—C, nutrients, and water quality
- Prescriptions for Clean Development Mechanisms (CDM)

#### *Vegetation Mapping, Inventory and Assessment*

- Vegetation classification at multiple spatial scales
- Process-driven modeling of vegetation growth and trajectories
- Aerial photo interpretation, LiDAR, and ground-truth analysis
- GIS mapping & analysis and use/ application of fire models

#### *Ecological Assets, Land-Uses & Mitigation*

- Watershed resource and land-use mitigation design to enhance water quality and other ecosystem services
- Site design for projects geared toward CDM/ REDD
- Communication with local governments and stakeholders
- Creative problem solving skills using limited resources

## **Range of Project Experience**

### **ECOLOGICAL ASSETS, CLIMATE CHANGE & CARBON SEQUESTRATION**

***Climate Change/ Carbon Assessment -- Pacific Islands.*** Institute of Pacific Islands Forestry – USDA Forest Service / NASA-Ames Earth Sciences / Federated States of Micronesia, Yap State. Project duration: 4/2008 to 6/2010 (ongoing). Chris worked as a charter member of a small “advance team” to quantify impacts of sea level rise and ridge-to-reef sediment distribution on mangrove systems. As a supplement, provided assistance to NASA to develop early logistic support to conduct an experimental flight of an unmanned SIERRA aerial vehicle for use in collecting remotely sensed data (laser altimetry, scanning aperture radar and hyperspectral imagery) for Yap and outer islands. Results of the overall project are designed to provide empirical data necessary to predict the current and potential losses of total ecosystem carbon pools as well as losses of taro agricultural lands due to disturbances and changes in sea level. Outcomes are designed to provide Yap with management solutions to better identify key land resources for sustainability amid pressures of rising sea levels and immigration from outer island communities. Island-scale carbon measures were used in intergovernmental discussions for potential REDD offsets, with focus on upland reforestation of native & multi-use agroforest.

***Climate Change Effects on Wetland Function.*** Institute of Pacific Islands Forestry – USDA Forest Service / Republic of Palau, Micronesia. Project Duration: 3/2007 – 5/2009 (ongoing). Chris worked with a team to quantify the impacts of sea level rise on mangrove forests in the tropical Pacific. Work involved quantifying the total ecosystem carbon and nutrient pools along a micro-elevational gradient from the upland-mangrove transition to the mud flats/sea grass communities important for the local fishery. Outcomes include modeling sea level rise effects on the *ecosystem services* provided by mangrove buffer areas (hurricanes/ typhoons, carbon storage, food webs/ fisheries, sediment, etc). Presented findings to government, NGO and international agencies in Palau, greater Micronesia, and the United States. Publication is in preparation.

***Ecosystem Impacts of Land Use on Climate Change.*** Multiple Partners: United States, Mexico, Costa Rica, Brasil. Project Duration: 3/1996 – 9/2008. Chris participated in a highly detailed and large-scale assessment of the total ecosystem carbon and nutrient pools (soils, roots, above ground) to quantify the atmospheric and terrestrial impacts of land-use conversion in the Neotropics. Work specifically involved the measurement, mapping, and scaling of many different forest types through the cycle of conversion to agriculture and fallow through deforestation and fire events. Outcomes included the fate and transport of terrestrial carbon pools to the atmosphere, the assessment of land-use viability following combustion and conversion, and the minimum considerations/ sensitivities associated with measuring C pools and creating high-value CDM/ REDD projects. Work has been presented to international panels, governments, and the scientific community. Peer-reviewed publication is in press to *Ecological Applications* (est. print date 12/08 – 3/09).

***Portland Metro Greenways Assessment.*** Metro, Portland, Oregon. Project duration: 4/2007 to 5/2007. Chris served as project manager and landscape ecologist with a team to assess the potentials for aquatic resource conservation and enhancement prior to development and expansion of the Portland metropolitan area. Project outcomes included a prioritization matrix to rank areas in the Clackamas River Basin for aquatic species and habitats, riparian zone connectivity and forest health, invasive weed species, and stream channel diversity. Site-specific priorities were identified for potential acquisition and resource enhancement.

***Pacific Greenways Assessment.*** Friends of Forest Park, Portland, Oregon. Funding provided by the Wildland Trust. Project duration: 4/2006 – 6/2006. Chris participated in a team to reassess the 1991 Pacific Greenway proposal to evaluate and ground truth the current conditions, and conduct a recreation and geographical (GIS) assessment along transportation routes from the Oregon Coast to Forest Park in Portland, Oregon. Specific tasks involved the evaluation of forest and non-forest conditions, invasive and non-native plant species, wildlife habitat, and aquatic resources as they pertain to land ownership along each of the Greenway routes. Preliminary recommendations for habitat enhancement in the Greenways were provided as part of the analysis.

***Biscuit Fire Retrospective Analysis.*** Forest Sciences Laboratory, Oregon State University. Project duration: 6/2006 to 11/2006. Chris provided detailed information as to pre-fire conditions for the 2001 Biscuit Fire using digital orthoquad imagery. Information collected includes the vertical and horizontal structure and composition of forest, hardwood, chaparral, grasslands, and shrub/ scablands for managed and unmanaged stands to evaluate pre-fire conditions on the immediate post-fire effects.

***Carbon Pool and Biodiversity Assessment – Los Tuxtlas Biosphere Preserve.*** US-EPA, Oregon State University, Corvallis, OR, Estación Biológica de Los Tuxtlas, Veracruz, México. Project Duration: 3/1996 – 5/1999. Chris designed and implemented a region-wide assessment (~1 million ha) of the species composition and carbon/ biomass storage along an elevational and soils gradient for primary tropical wet and tropical cloud forests in SE Mexico. Work involved sample design, field sampling, logistics, and assessment of the total ecosystem C pools for the region, and an assessment of the shifts in the over 450 plant species along the gradient to maximize biosphere conservation goals. Presented information in English and Spanish to international government agencies, the scientific community and the media. MS thesis was completed as part of this project.

## **WATERSHED ASSESSMENT**

***Granite Creek Watershed Assessment and Action Plan.*** USDA Forest Service, Idaho Panhandle National Forest/ Kalispel Tribe, Idaho/Washington. Project duration: 7/2007 to 3/2009 (ongoing). Chris worked with a team to conduct a watershed assessment and action plan for bull trout and cutthroat trout restoration opportunities in a ~65,000 acre watershed near Priest Lake, Idaho. Chris provided a strategy for inventory, mapping, and enhancement prescriptions in riparian zones, specifically for *ecosystem services* (shade, LWD recruitment, nutrient inputs, etc) for the riparian zones on fisheries habitats.

***Wilson River Watershed Analysis.*** Oregon Department of Forestry, Salem, Oregon. Project duration: 2/2007 to 3/2008. Chris worked with a team to conduct a watershed assessment in Northwestern Oregon following a modified version of the Oregon Watershed Assessment protocol. Chris served as the riparian and upland vegetation specialist to assess the patterns and trends of the vegetation, develop the preferred/ desired future conditions of the vegetative conditions, and to provide recommendations for riparian enhancement to improve fisheries habitats. Work involved the fine-scale mapping and modeling of forest growth and mortality over a 100 year timeframe, and identified time lags where large wood was limiting to the stream system.

***North Fork Coeur d'Alene River Watershed Assessment.*** Coeur d'Alene River Basin, Idaho, Idaho Department of Environmental Quality. Project duration: 09/2005 to 3/2007. In 2001 the Idaho Department of Environmental Quality completed a Total Maximum Daily Load (TMDL) assessment of the North Fork Coeur d'Alene River Basin. The TMDL was developed primarily for coarse sediment inputs to the system. Chris evaluated the current vegetation patterns and developed a suite of reference conditions for use with modeling the effects of management

scenarios (primarily timber harvest and road construction) on sediment inputs and stream dynamics in the Basin. Developed vegetation parameters for a distributed hydrology, soils and vegetation model to quantify the inputs.

***Drews Creek Watershed Analysis.*** Goose Lake Basin, Oregon, Fremont-Winema National Forest. Project duration: 10/2005 to 8/2006. Chris served as the lead ecologist for a 170,000 acre watershed analysis for US Forest Service near Lakeview, OR. He developed an aerial photo interpretation protocol to delineate homogeneous vegetation patterns and to provide detailed information as to species, size, and canopy cover among forested layers; riparian zones were attributed with coarse classifications that followed the Forest plant association guidelines. Data generated were used to quantify and describe the major vegetation types on the landscape, their forest stand development stages, fire regimes, snag distribution and recruitment, riparian vegetation types among different channel types, stream shading, and LWD recruitment. A suite of desired future conditions were developed following the Forest management plan, and treatment recommendations were provided (including silvicultural options) to improve forest health, minimize fire risk, and increase riparian zone interaction with the stream channel.

***Canyon Creek Watershed Assessment.*** John Day River Basin, Oregon, Malheur National Forest. Project duration: 11/2002 to 08/2003. Participated in an interdisciplinary team to conduct an ecosystem analysis for the Canyon Creek watershed in eastern Oregon (~75,000 acres). Focus was on historic and current vegetation structure, composition, and functioning with respect to disturbance events (timber harvest, fire, insects and diseases). Quantified forest structure and composition, and classified stands as to their potential for uncharacteristically severe wildland fires within the wildland-urban interface (WUI). Provided recommendations for site-specific silvicultural and prescribed fire treatments that would be required to re-introduce fire as an important disturbance process to minimize crown fire hazards. Results have been incorporated into decision-making documents (NEPA) with an ultimate goal to reduce large-scale fire hazards within local urban and rural communities in the Canyon City/ John Day area.

## **PROJECT DESIGN, ANALYSIS & NEPA COMPLIANCE**

***Whychus Creek Stream Restoration.*** City of Sisters, Oregon/ Upper Deschutes Watershed Council. Project duration: 4/2008 to 6/2009 (Ongoing). Served as the riparian ecologist for a stream enhancement/ restoration project involving Whychus Creek, which flows through the City of Sisters, Oregon. Developed a matrix of current and potential future conditions meeting a 30% design criteria to enhance stream shade, bank stability, and other *ecosystem services* meeting fisheries enhancement goals. Analyzed fine-scale LiDAR imagery to identify geomorphic surfaces suitable for restoration or enhancement within the urban area, and prescribed specific treatments to enhance shade, LWD, floodplain conveyance, and bank stability options.

***Pinchot Partners Plantation Restoration Environmental Assessment (EA).*** Cowlitz River Basin, Washington, Gifford Pinchot Collaborative Working Group. Project duration: 11/2005 to 3/2007. Chris worked with a team to complete an Environmental Assessment (EA) addressing (and mitigating) the potential impacts associated with thinning ~1,900 acres of 30 to 100 year old plantations on the Cowlitz Valley Ranger District.

***Conger Wildland/Urban Interface Fire and Fuels Reduction Environmental Assessment (EA).*** Newport and Sullivan Lake Ranger Districts, Colville National Forest. Project Duration: 10/2004 – 12/2005. Lead ecologist and technical project manager for a fuels reduction and timber harvest project within the wildland-urban interface of Forest Service lands in NE Washington. The 5,700 acre analysis area is highly diverse with a complex mosaic of both fire-dependent and fire-intolerant communities. Prepared the Fire/Fuels and Silviculture Specialist Reports for NEPA documents. Assessed the current and potential natural plant communities

using aerial photography and ground truth analysis, modeled fire behavior at local (stand) and landscape (analysis area) scales, with the goal to restore the historic and natural range of variability in forest composition, structure, and fire regimes.

***Wildlife Biological Assessment/ Evaluation (BA/BE): Silvicultural Treatments.*** Newport and Sullivan Lake Ranger Districts, Colville National Forest. Project Duration: 3/2004 – 7/2004. Conducted a BA/BE for threatened, endangered, and regionally sensitive wildlife species for a series of precommercial thinning treatments throughout two ranger districts on the Colville National Forest. Evaluated current habitat conditions and quantified effects of silvicultural treatments on wildlife species, including grizzly bear. Provided mitigations and guidelines for minimizing potential impacts on habitats and species.

***Upper Sycan Grazing Allotments Environmental Assessment (EA).*** Sprague River and Summer Lake Sub basins, Oregon, Fremont-Winema National Forest. Project duration: 08/2004 – 08/2005. Chris served on a team to conduct an Environmental Assessment (EA) to evaluate potential effects of a livestock grazing program on 8 grazing allotments (~250,000 acres in size). Chris provided the analysis for determining the timing and use of livestock grazing in riparian zones, and the effects of that use on bank stability, riparian floodplain interaction and aquatic habitat.

***Stream Habitat Assessments.*** Malheur National Forest. Project duration: 9/2001 – 10/2004. Provided the data analysis and technical review for an average of 40 stream miles for 4 consecutive years (2001-2004). Evaluated the aquatic habitat attributes as to their functioning for salmonid habitat according to ODF&W, PACFISH and INFISH standards as well as the desired future conditions set forth by the Malheur National Forest. Lead author for the documents that outlined the factors limiting fish populations in the watersheds and provided specific recommendations to enhance salmonid habitat and riparian ecosystem functioning. Information has been prepared for use in watershed analyses and NEPA documents.

## **ANALYTICAL CHEMISTRY & ECOLOGICAL APPLICATIONS**

***Mangrove Redox and Sediment Dynamics.*** USDA Forest Service – Institute of Pacific Islands Forestry, Republic of Palau. Project Duration: 3/2007 – 4/2008. A pilot project to determine the ranges of soil redox potentials during tidal events in mangrove forests. Installed multiple titanium probes at various depths along a tidal gradient, and sampled over a six month period. The work was designed to better understand carbon dynamics associated with the sediment flow, water table elevations, and soil chemistry in highly organic soils. Outcomes were presented internally and in brief communications to determine the needs for monitoring change in redox as potential predictors for mangrove mortality and change due to sea level rise.

***Floodplain Meadow Total Ecosystem C & Nutrient Flows.*** Fisheries & Wildlife, Oregon State University, Corvallis, OR. Project Duration: 6/1995 – 2/1998. Installed a range of groundwater sampling wells to measure water table depth, soil redox potential, and sample and model groundwater C and N flow in montane riparian meadows throughout the Blue Mountains, Oregon. Results were used to apply as standards for reference conditions for soil chemistry, floodplain meadow interaction, plant species composition, total ecosystem biomass, C, N and S, and groundwater flow dynamics.

***Small-Scale Water Quality Projects.*** Runa/ Sarayaku Nation, Rio Pastaza, Ecuador/Peru border region, Amazon Basin. Project Duration: 1/1995 – 6/1995. Chris worked with the tribe to obtain funding and to build cisterns to collect clean water for use for ~50 person family tribal encampments to mitigate the effects of road building and oil exploration in the Amazon. Work involved *in-situ* water quality measurements to determine appropriate placement of cistern/

screen systems. Mobilized communities for construction and conducted post-project quality monitoring.

***Pilot Bioactive Essential Oil Production -- QA/QC & Methods Development.*** Forest Products, Oregon State University, Corvallis, OR. Project Duration: 6/1994 – 1/1995. Developed QA/QC method and assisted in the design to produce consistent, high-level yields of bioactive compounds derived from forest resources and mill residues for use in forestry, agriculture and protection of human health. Role included the development of solvent-based and solvent-free extraction for quantifying the polyphenol and sesquiterpine quality and concentrations.

***Methods Development: Solvent-free SPME-GC Analysis as a Standard for Sampling Volatile Organic Compounds.*** Oregon State University, Corvallis, OR. Project Duration: 11/1992 – 3/1994 (BS Thesis). Developed new applications for a cutting-edge coated fiber technology for use in a solvent-free headspace equilibrium extraction of plant-derived volatile compounds, using the aroma characteristics in hops as the test medium. Methods and accuracy tests against standard solvent-based systems proved to dramatically reduce the time, lab hazards, and expense for analysis. The solvent-free method is now a widely accepted industry standard for evaluating aroma characteristics in the beer industry, spawning a range of other applications in food science.

## **GIS MAPPING, DATABASE SUPPORT & WEB TOOLS**

***Watershed Explorer.*** Watershed Professionals Network (WPN) – *Internal Marketing Project.* Project Duration: 2/2008 – (ongoing). Co-leader for a web-based data delivery system for internal and client delivery. The system is designed to apply spatial GIS data with source data collected in the field, including photographs, using platforms that are supported by Google Earth and other spatial search technologies. The system is also designed to be a repository for stakeholder engagement to readily contribute to the knowledgebase, where appropriate. The project is housed on a secure server and is under development.

***Klamath Basin Metadata On-Line Database.*** Watershed Initiatives/ NOAA Fisheries, Arcata, CA. Project Duration: 2/2008 – 3/2009 (Ongoing). Project Manager & lead developer. In response to the Klamath Basin Restoration Agreement, Chris designed and implemented on-line database tool for Basin natural resource specialists (Federal, State, Tribes, private) to provide basic information about data that is potentially suitable for long-term monitoring. The tool involves integration of a MySQL database server with a secure and user-friendly method for data input. The anticipated outcomes include a dynamic tool for stakeholder collaboration for use in monitoring.

***iLevel 4-D Performance.*** iLevel by Weyerhaeuser, Boise, Idaho. Project duration: 2/2008 to 3/2008. Provided a national dataset of climate potentials and hazards (precipitation, snow load, windspeeds) for use in a database to best match specialty-building products with the ranges of natural conditions.

***Vegetation Mapping.*** USDA Forest Service, Malheur National Forest, John Day, OR. Project duration: 1/2002 to 08/2003. Lead ecologist and project manager for a ~1.8 million acre photo interpretation project to provide detailed information on forest structure and species composition including size, canopy cover, and forest layers of the entire Malheur National Forest. Work involved the re-delineation and GIS editing of USFS stands, aerial photo interpretation, and database design and management. Created complex relational databases using Access to link CVS inventory data, GIS, and photo interpreted data with environmental attributes of stands (soils, aspect, slope, and elevation). Analyzed data to ascertain plant associations and forest vegetation potential for ~660,000 acres.

## SCIENTIFIC OVERSIGHT, EXPERT WITNESS & FEASIBILITY ANALYSES

***Independent Large Fire Cost Review.*** Secretary of Agriculture, WO office of Fire & Aviation, Washington D.C. Project Duration: 4/2007 – 6/2010 (estimated). Chris is working with a team to assess the large cost fire incidents (>\$10 Million) within the 2008 and 2009 fire years. Specific duties include gathering and assessment of fire information, land management practices, on-call dispatch databases, in-field financial databases, decision support tools, and Agency-wide financial databases. The major objective of this work is to address how the system functions, and to identify areas or data gaps that assist fire managers with decision support tools to promote safety at lower overall costs.

***Biomass Utilization/ Sort Yard Feasibility Analysis.*** Clackamas County Soil & Water Conservation District, Oregon City, OR. Project Duration: 6/2005 – 12/2005. Conducted a pilot feasibility analysis to develop a County-sponsored log sort yard and biomass utilization (hog fuel) facility near Molalla and Sandy, Oregon. The objectives were to provide a certainty of supply of small-diameter logs to local and regional wood product manufacturers, stimulate a viable business to stimulate jobs and lower costs to landowners/developers for fuels reductions, and to increase value to existing products through alternative market development. Stakeholders included industrial and non-industrial private timberland owners, small mills, cogeneration power plants, and Clackamas County.

***Salmon and Water Management in the Klamath Basin.*** Klamath Assessment Group, Oregon State University/ University of California, Davis, Office of the Governor of California and Oregon (Special Appointment). Project duration: 6/2001 – 12/2001. Participated in an independent task force to evaluate and review the status and trends of the Klamath Basin from a social, economic, and natural resource perspective following the regional water crisis during the severe drought year, 2001. Acted as an independent specialist to review the science of state and Federal documents and to assist the broadest possible readership in understanding the controversies associated with coho salmon in the Klamath Basin. The document was targeted toward Federal agencies, State and Federal legislators, Tribes, the media, and the general public.

***Mono Basin Tributaries Water Use and Riparian Zone Conditions—Water-use Decision.*** State of California vs. Los Angeles Department of Water and Power. Project Duration: 6/1996 – 6/1998. Served as the associate riparian ecologist for an expert witness team to monitor and evaluate the effects of water releases on the composition, structure, and functioning of riparian zones through time for tributary creeks of Mono Lake from 1987-1996. Collected, analyzed, and interpreted riparian vegetation and stream structure data through aerial photograph interpretation and ground-truth analysis. Modeled the trajectory of riparian plant communities as it related to increased water releases from dams and the cessation of livestock grazing. Provided technical reports and detailed maps for expert witness testimony regarding future water use for the city of Los Angeles. Spawned study for peer-review publication.

***Plant Germplasm Exploration, Mapping and Collections.*** USDA Agricultural Research Service and Multiple Partners in Andean Countries, South America. Project Duration: 11/1994 – 6/1996. Role involved exploration and mapping of culturally significant and commercially viable plant species, particularly blackberries, blueberries, raspberries and strawberries. Researched ~500 year old archives and followed the Inca Trail to isolate “land race” cultivars of the small fruits for genetic preservation and breeding for world-wide agricultural programs. Exported samples to current breeding programs, and worked with a team to initiate a program to provide a cross-cultural exchange between South American farmers and scientists from the United States, Europe and New Zealand. Two peer-reviewed publications.

## **CURRENT ON-CALL CONTRACTS**

***City of Salem – Water Resource On Call Services.*** City of Salem. Project Duration: 3/2008 – 6/2009 (with 4 option years)(ongoing). Chris serves as the project leader for providing on-call services for meeting the City’s natural resource/ water resource needs. Subject areas include Biological Services, Aquatic/Hydrologic Services, and Watershed Planning and Public Involvement services. Chris manages and directs these projects with WPN team members, on an as-needed basis.

***USDA Forest Service, Region 6 IDIQ Professional Services.*** Regional Office, Portland, Oregon. Project Duration: 5/2007 – 5/2010 (ongoing with option years). Chris is the WPN program manager for a full professional services contract for Region 6 (Washington/ Oregon) Forest Service lands. Contract includes on-call services for NEPA, cultural resources, soils, hydrology, botany, wildlife and fisheries, geology, technical writing, rangeland resources, forest ecology, silviculture, air quality, recreation, fuels, forestry activities, and GIS applications. Chris builds project teams comprised of WPN members and subconsultants on an as-needed basis.