



# Rabia Ahmed

## PRINCIPAL ECONOMIST/MANAGING PARTNER

Rabia Ahmed is an environmental and development economist with over 15 years of international experience in community and social assessment, policy and regulatory economics, economic modeling, survey design and analysis, water and natural resource economics, and litigation support. She has extensive experience in conducting socioeconomic and environmental justice impact analyses for National Environmental Policy Act projects. At the international level, Ms. Ahmed has worked directly with communities in many countries and has been involved in a number of environmental and social impact assessments. She has also conducted studies on the economic impacts, costs, and benefits of critical habitat designations under the Endangered Species Act, focusing on impacts of such designations on commercial, governmental, and private activities. She specializes in understanding the links between environmental impacts and how these translate into economic and social effects.

### Qualifications

- MS, Economics: Portland State University, Portland, OR
- MS, Economics: Quaid-i-Azam University, Islamabad, Pakistan
- BS, Economics and Statistics: Punjab University, Lahore, Pakistan

### Expertise

- Policy and Regulatory Economics
- Endangered Species Act Compliance
- Environmental Economics
- NEPA/SEPA/CEQA Compliance
- Community/Social Assessment
- Impact Analysis/Assessment
- Economic Modeling
- Survey Design and Analysis
- Water Rights

### Language skills

- English (fluent—written/spoken)
- Hindi (spoken only)
- Urdu (native—written/spoken)
- Punjabi (fluent—written/spoken—local dialect in the Punjab Provinces of India and Pakistan)
- Hindko (fluent—written/spoken—local dialect in the Hazara Region of Pakistan)

Ms. Ahmed has assisted with cost-benefit analyses, Natural Resource Damage Assessments, ecosystem service valuations, and analyses of regulatory impacts. She is also well-versed in water laws and water markets in the U.S., and has expertise in conducting water demand analysis, valuation of ground and surface water, assessment of water rights, water supply security analyses, and water rights applications processes. Ms. Ahmed has many years of experience in survey design, implementation, and participatory research methods, as well as in conducting public outreach using focus group discussions and open-ended questionnaires. Her quantitative background includes statistical analyses, including linear regression, using a variety of software packages.

Ms. Ahmed's professional and board experience includes the following:

- Board Member, American Water Resources Association (AWRA) – Washington Section (Vice President for 2018, Secretary for 2017)
- Member of American Water Resources Association—National
- Conference Co-chair for the American Water Resources Association—Washington Section 2016 Annual State Conference
- Member of Strategic Relations, Finance, and Conference Committees for American Water Resources Association—Washington Section
- Chair of Networking; Member of Strategic Development, Education, and Budget Committees for Women in Environment—Seattle and Portland
- Board Member, Women in Environment—Seattle and Portland
- SYLFF Fellow (The Ryoichi Sasakawa Young Leaders Fellowship Fund) since 2003



## Relevant Projects

### **Social and Community Assessment**

#### **North Steens 230Kv Transmission Line and Wind Farm Environmental Impact Statement for Columbia Energy Partners – Harney County, Oregon**

**Socioeconomics and Environmental Justice Analyses**—Ms. Ahmed led the environmental justice analysis and contributed to the socioeconomics analysis for an EIS on a proposed wind energy development that includes a utility-scale wind farm with 100 turbines and approximately 29 miles of double-circuit 230kV electric transmission line in Harney County, Oregon. The applicant, Columbia Energy Partners, is seeking a 150-foot-wide right-of-way for approximately 8 miles of the transmission line to be located on Bureau of Land Management-administered lands and an additional 1 mile of transmission line on the Malheur National Wildlife Refuge, which is managed by the U.S. Fish and Wildlife Service. The environmental justice analysis identified low-income and minority groups that might be differentially affected by the proposed project in Harney County, as well as major cities, Census Block Groups, and other areas in the vicinity of the project. Geographic Information Systems software and other methods were used in the analysis.

#### **Mohave County Wind Energy Environmental Impact Statement for BP Wind Energy North America – Mojave County, Arizona**

**Socioeconomics and Environmental Justice Analyses**—Ms. Ahmed was a key member of the team conducting the socioeconomics and environmental justice assessments for the Mohave County Wind Energy Project EIS. The wind energy project proposed by BP Wind Energy would be on Bureau of Land Management land in the While Hills of northwestern Arizona. The project would include as many as 333 wind turbines with generating capacity of up to 500 megawatts. The analysis included assessing the impacts of the project on local jobs, income, property values, recreation, taxes, and equity. Ms. Ahmed led the environmental justice analysis, which examined the potential impacts of the proposed project on low-income and minority populations. The analysis was carried out at the levels of Census Tracts, Census Block Groups, and major cities in order to identify concentrations of, and potential effects on, such groups. Geographic Information Systems software and other methods were used in the analysis.

#### **Environmental Impact Statement, Alaska Standalone Pipeline, Alaska Gasline Development Corporation – Alaska**

**Socioeconomics and Environmental Justice Analyses**—The State of Alaska proposes to construct and operate a 24 inch-diameter, high-pressure pipeline from Alaska’s North Slope to Cook Inlet for transportation of North Slope Natural Gas to in-state Alaska markets. Gas-off take would be provided for the Fairbanks area and for other locations along the route. The project includes a gas conditioning plant on the North Slope, compressor stations along the pipeline, and natural-gas-extraction facilities producing utility-grade natural gas. The U.S. Army Corps of Engineers is the lead agency. Cooperating agencies include the Bureau of Land Management, the National Park Service, and the U.S. Environmental Protection Agency. Ms. Ahmed evaluated the pipeline’s fiscal and employment implications to area residents and conducted the environmental justice analysis for residents in the project area.

#### **Impact Assessment of ActionAid’s Microfinance Program in Jamalpur, Bangladesh**

**Economist and Community Specialist**—As part of an international team of economists and community development experts, Ms. Ahmed looked at the economic and social impacts of ActionAid’s ten-year-old microfinance program in 20 rural communities of the Jamalpur region in Bangladesh. Special emphasis was given to impacts on women. Ms. Ahmed lived in the community for more than a month, conducting surveys and interviews using participatory techniques such as Participatory Rural Appraisal and REFLECT.

## **Environmental Impact Statement, Fee-to-Trust Action for the Soboba Band of Luiseño Indians – Riverside County, California**

**Socioeconomics and Environmental Justice Analyses**—The Soboba Band of Luiseño Indians proposes to transfer into trust status 35 parcels aggregating to 534.97 acres currently held in fee title. The Band also wishes to relocate its existing casino, on trust land, to the land proposed for trust status. In addition to the casino, the property will be developed with a hotel, recreational vehicle park, Tribal buildings, and retail enterprises. Ms. Ahmed led the socioeconomics team and conducted a comprehensive socioeconomics and environmental justice analysis for the EIS required under the National Environmental Policy Act for the fee-to-trust process by analyzing data from various sources, using Geographic Information Systems software and other methods. A comprehensive economic assessment of proposed fee-to-trust land transfer for the Tribe was prepared, including an analysis of proposed retail and commercial establishments. The environmental justice analysis identified low-income and minority groups in the City of San Jacinto, Riverside County, and other areas in the vicinity of the proposed project who might be differentially affected by the project. Ms. Ahmed also assisted in the development of the fee-to-trust application submitted to the Bureau of Indian Affairs.

## **Five Environmental Assessments, Fee-to-Trust Action for the Skokomish Tribe – Mason County, Washington**

**Socioeconomics and Environmental Justice Analyses**—Ms. Ahmed led the environmental justice analysis and contributed to the socioeconomics analysis for five environmental assessments for 18 properties being proposed for fee-to-trust transfer by the Skokomish Indian Tribe. Each EA is unique to the subject properties, for which a wide range of land uses are proposed, varying from commercial to housing to habitat conservation. The Bureau of Indian Affairs has designated these projects for “fast track” National Environmental Policy Act compliance, and Ms. Ahmed analyzed data from various sources, using Geographic Information Systems software and other methods. The environmental justice analyses identified low-income and minority groups in the vicinity of the project site who might be differentially affected by the proposed project.

## **Environmental Impact Statement, Department of Fish and Game and U.S. Forest Service Lake Davis Pike Eradication Project – Plumas County, California**

**Environmental Justice Analysis**—For the joint environmental impact report/EIS, Ms. Ahmed conducted the environmental justice analysis of eradicating the northern pike (*Esox lucius*) from Lake Davis, California. Lake Davis serves as an important recreational venue for trout fishing, boating, shoreline-based camping, and other day uses, as well as a domestic water supply. The objective of this project is to eradicate pike from Lake Davis and its tributaries, using the pesticide rotenone (liquid or powder formulations) to prevent the pikes’ downstream spread and reduce the chances that they will relocate to other California waters. Potential impacts included temporary losses of income and jobs in a small rural area. U.S. Census data were analyzed, using Geographic Information Systems (GIS) software, to identify low-income and minority groups that might be differentially affected by the project. The study satisfied federal guidelines for social, economic, and environmental justice impact assessment.

## **Washington State Department of Natural Resources Aquatic Lands Habitat Conservation Plan Environmental Impact Statement – Washington**

**Environmental Economist**—Ms. Ahmed assisted with an EIS for a proposed HCP for Washington State aquatic lands. She conducted the environmental, socioeconomics, and environmental justice analyses of the various measures provided in this HCP. This plan is proposed to be implemented on the 2.4 million acres of submerged lands managed by the DNR throughout the state. These various measures could have ramifications for the owners of overwater structures such as marinas, ports, and docks. Additionally, the HCP could have implications for aquaculture farms, as well as forestry operations, that use state aquatic lands.

## Programmatic Environmental Impact Statement for the National Marine Fisheries Service Hawaiian Monk Seal Enhancement Actions – Hawaii

**Socioeconomics Lead**—Ms. Ahmed is part of a team conducting a programmatic EIS for Hawaiian monk seal enhancement actions in the Main Hawaiian Islands and the Northwestern Hawaiian Islands. The goal of the programmatic EIS is to provide NMFS with a logical and legally defensible analysis of potential significant environmental impacts related to reasonably foreseeable new initiatives for Hawaiian monk seal enhancement, including: (1) translocations of Hawaiian monk seals within their natural range; (2) vaccination research and implementation; and (3) treatment for parasitic infection (i.e., deworming). All these initiatives must be authorized through the NMFS permitting process by the Office of Protected Resources, Permits Division (F/PR1). The programmatic EIS will establish a framework of potential activities from which NMFS can tier for future enhancement actions. Among other tasks, Ms. Ahmed worked on analyzing the socioeconomic impacts of these enhancement actions on subsistence, commercial, and recreational fishing; recreation; tourism; and public safety.

## Aurora Gold Project, Guyana Goldfields, Inc. – Guyana

**Social Expert**—Ms. Ahmed was part of the team conducting a social impact assessment as part of an updated environmental and social impact assessment of Guyana Goldfields, Inc.’s project involving the development and construction of a gold mine and associated facilities. The team conducted social baseline studies of artisanal and small-scale mining settlements and local communities, and led public consultations with local communities, governmental authorities, nongovernmental organizations, and other key stakeholders. The updated ESIA was developed to meet international lenders’ requirements. Ms. Ahmed was also involved in preparing the environmental, social, health, and safety monitoring plan to support the final ESIA prepared for the project in accordance with International Finance Corporation requirements.

## Preparation of High-Level Environmental and Social Impact Assessment Guidelines for Hybrid Wind/Photovoltaic Solar/Storage Projects, Confidential Client – India

**Social Expert**—Under the U.S. Trade and Development Agency grant for Technical Assistance program, the client is undertaking a techno-economic feasibility study of an integrated wind, solar, and energy storage project with locations in Andhra Pradesh and Gujarat. Ms. Ahmed conducted a high-level desktop study designed to provide practical guidance in conducting ESIA for the project and similar future projects. The ESIA are required for projects that are fully “bankable,” i.e., they not only comply with applicable Indian regulations, but they also address all eight International Finance Corporation Environmental and Social Performance Standards, applicable World Bank Group Environmental, Health, and Safety Guidelines, and Equator Principles III. The study will provide generic guidance to the client for the structuring of ESIA for the project, as well as for future wind/ PV solar/storage projects in India, in compliance with applicable Indian regulations, IFC PS, applicable IFC EHS guidelines, and EPIII. Ms. Ahmed carried out an analysis of the potential applicability of IFC PS to typical hybrid wind, solar, and storage power projects in India. The report identified and reviewed a number of Indian regulations that could be relevant to typical hybrid wind, solar, and storage power projects in the country, and that invoke the ESIA process. The study also investigated Indian and international regulations pertinent to battery energy storage systems (BESS), which are increasingly being employed as part of renewable energy projects. Finally, Ms. Ahmed developed detailed Terms of Reference for conducting the ESIA for the project in Andhra Pradesh and Gujarat.

## Stakeholder Outreach, Facilitation, and Survey Design and Analysis

### Focus Groups Concerning Voter Willingness to Pay for Parks – Gig Harbor, Washington

**Environmental Economist and Facilitator**—Ms. Ahmed designed and facilitated several focus groups designed to gauge the public’s preferences relative to park and recreation assets on the Gig Harbor peninsula and public views of a bond measure to support strengthening and growing the park and recreational facilities. The focus groups provided the client with an understanding of the range of views of area residents regarding the existing

parks system, their preferences for various types of parks and recreation improvements, and factors affecting their willingness to support a bond measure.

## **Recycling Feasibility Analysis – Clark County, Washington**

**Economist and Facilitator**—Ms. Ahmed developed and facilitated focus groups of citizens to determine strengths and weaknesses of the existing recycling system and a proposed future system. Based on the results from the focus groups, her team designed a follow-up telephone survey. Results of both the telephone survey and the focus groups were compiled in an overall feasibility study of alternative recycling strategies. Based on the study, a pilot study was developed and Ms. Ahmed was again part of the team that designed and facilitated focus groups and a mail survey, and conducted the data analysis for the county.

## **Baseline Study of Economic and Social Situation in Bahawalpur and D.I. Khan – Pakistan**

**Team Leader**—Ms. Ahmed led a team of economists and development professionals in conducting a survey of the baseline economic and social situation in 30 communities in Bahawalpur and D.I. Khan in Pakistan. The effort included training the team in participatory methodologies, developing survey tools, econometric analysis of data, and feasibility analysis for intervention in the two areas.

## **Baseline Study of Socioeconomic Conditions in the Hazara Region – Kyhber-Pakhtunkhwa Province, Pakistan**

**Team Leader and Principal Trainer**—Ms. Ahmed was the team leader in studying the baseline socioeconomic conditions of 58 communities in the Hazara region of Pakistan. The project involved a combination of quantitative and qualitative data-gathering techniques, e.g., structured surveys, open-ended interviews, and focus group discussions using Participatory Learning and Action tools. Ms. Ahmed trained the team members and enumerators in conducting surveys and participatory methodologies.

## **Situational Analysis of Sexual Harassment in the Workplace – Pakistan**

**Team Leader**—Ms. Ahmed surveyed the existing situation through case studies of various sectors and analysis of available data. She identified the key causes of increased incidence of sexual harassment at workplaces in Pakistan. The study informed a national-level campaign on the issue that inspired about 300 (to date) organizations and institutions to adopt and develop policies against sexual harassment.

## **Ganado Family Farm Agricultural Marketing Study: Demand for Traditional Foods and What This Means for Farmers – Navajo Indian Reservation, Arizona**

**Environmental Economist**—Ms. Ahmed built this study on the results of an earlier project that outlined the processes by which small farmers in Ganado and other parts of the Navajo reservation would process and sell traditional Navajo corn products. To further develop the traditional Navajo product line, the project surveyed the Navajo population and others to estimate market demand. Results from the estimated demand were used to measure the size of the production effort that may be supported by the market.

## **Regulatory Analysis**

### **Economic Analysis of Proposed Stream Protection Rule, National Mining Association – Various US States**

**Economist**—Ms. Ahmed reviewed the Office of Surface Mining’s SPR on behalf of the NMA. The project involved reviewing the SPR and analyzing the impact of the proposed rules on costs, reserves, and delays in obtaining permits for the mining industry. In addition, Ms. Ahmed conducted an economic analysis of the impact of the SPR on employment, compliance cost, value of reserve, and regional and local governments. Specifically, Ms. Ahmed conducted several interviews with a large sample of coal producers across the country, including in Wyoming, Montana, and North Dakota. The results of the survey work were synthesized in order to estimate the potential impact of the SPR on underground and surface mining, as well as the impact to the various coal mining regions across the country. Finally, the total impact to the national economy was estimated in terms of

jobs, income, output, and tax revenue. High and low ranges were calculated to account for various reasonable interpretations of certain key aspects of the rule. The results of the report assisted in SPR-related legislation.

## **Economic Analysis of Main Hawaiian Islands Insular False Killer Whales Critical Habitat Designation, National Marine Fisheries Service, Pacific Islands Regional Office's Protected Resources Division and Cardno – Hawaii**

**Lead Economist**—Ms. Ahmed is leading a team analyzing the economic, socioeconomic, and other costs and benefits associated with the designation of critical habitat for the Main Hawaiian Islands insular false killer whales' (*Pseudorca crassidens*) distinct population segment under Section 4 of the Endangered Species Act. Section 4(b)(2) of the ESA requires NMFS to consider the economic and national security impacts, in addition to any other relevant impacts, of specifying any particular area as critical habitat. Specifically, the team is providing draft and final economic reports focused on the economic impacts associated with the designation of critical habitat for the species. The assessment covers a broad range of activities potentially affected by the designation, including in-water and nearshore construction, activities that contribute to water pollution, military activities, energy projects, aquaculture and mariculture, environmental response activities, and federally managed fisheries. The study also provides a qualitative analysis of the benefits of designating critical habitat and a Regulatory Flexibility Act analysis to determine the potential impacts on small entities. The report will assist NMFS in determining if the benefits of excluding any particular area outweigh the benefits of including that area in the potential critical habitat. This effort is ongoing and Cardno is the prime.

## **Regulatory Impact Review / 4(b)(2) Preparatory Assessment / Initial Regulatory Flexibility Act Analysis for the Critical-Habitat Designation of Cook Inlet Beluga Whale – Alaska**

**Project Manager and Technical Lead for Socioeconomics and Environmental Justice Analyses**—Ms. Ahmed identified and analyzed the potential impacts to various land and water uses due to the proposed designation of critical habitat for the listed Cook Inlet Distinct Population Segment of beluga whale (*Delphinapterus leucas*), Alaska. The analysis measures effects on commercial fisheries; Alaska Native and subsistence use; oil and gas development; mining; transportation and other large-scale development/infrastructure projects; port expansion and development; wastewater discharge; wind, tidal and geothermal power development; recreation and tourism; military activities; and educational, scientific, and non-consumptive use. The report also includes an environmental justice analysis conducted to determine whether the proposed Cook Inlet beluga whale critical-habitat designation will have a disproportionate adverse impact on the Alaska Native tribes, corporations, and villages, as well as on other minority and lower-income groups. Further, the study analyzes the use and nonuse benefits of the proposed critical-habitat designation of Cook Inlet beluga whale in Alaska. Sources of potential benefits include subsistence-fishing activities in Cook Inlet and subsistence hunting of Cook Inlet beluga whales by Alaska Native corporations and communities.

## **Environmental Assessment / Regulatory Impact Review / Initial Regulatory Flexibility Act Analysis for the False Killer Whale Take Reduction Plan – Hawaii**

**Deputy Project Manager and Task Leader**—Ms. Ahmed was a key member of the team conducting an environmental assessment / RIR / IRFA analysis of the False Killer Whale Take Reduction Plan for the National Marine Fisheries Service, Pacific Island Region. The purpose of the TRP is to reduce incidental mortality of and serious injury to false killer whales in the deep-set tuna target longline/set line fishery and the shallow-set swordfish target longline/set line fishery. The TRP includes measures related to fishing gear requirements, exclusion zones, and training and handling protocol for false killer whales. The purpose of the study is to evaluate, to the extent practicable, the economic, socioeconomic, and other costs and benefits attributable to the alternatives. The team of economists worked closely with NMFS staff to identify and obtain the data required for the project, develop a technical method and initial findings memorandum, and develop a draft EA/RIR/IRFA analysis on a very short timeline. The project included estimating the capital and ongoing replacements costs associated with switching to different fishing gear, potential reduction in catch rates and overall total catch, and increased time and fuel costs due to travel outside nearshore exclusion zones. In addition to effects on commercial fishing, the analysis identified and evaluated potential impacts to subsistence and

recreational fishing, recreation and tourism, seafood consumers, fishing equipment suppliers, and educational/scientific/passive users. Direct and indirect benefits of reduced mortality and reduced serious injury were qualitatively described, based on a review of the use and nonuse literature as well as an analysis of the types of activities and populations in Hawaii that would benefit from increased false killer whale or associated species populations.

## **Economic Analysis of Critical-Habitat Designation for Plant and Animal Species in Eight States**

**Economist and Project Manager**—Ms. Ahmed identified and analyzed the potential impacts to various land and water uses due to the proposed designations of critical habitat for ten species in eight states (listed below). These analyses have included assessing the costs and benefits of critical-habitat designation on a variety of commercial and governmental activities. Ms. Ahmed also provided project management assistance and coordinated the activities of the teams working on these projects. The studies were conducted for the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, Division of Economics.

- Cook Inlet Distinct Population Segment of beluga whale (*Delphinapterus leucas*), Alaska. The analysis measures effects on commercial fisheries; Alaska Native and subsistence use; oil and gas development; mining; transportation and other large-scale development/infrastructure projects; port expansion and development; wastewater discharge; wind, tidal and geothermal power development; recreation and tourism; military activities; and educational, scientific, and nonconsumptive use.
- Main Hawaiian Islands insular false killer whales (*Pseudorca crassidens*) DPS, Hawaii. The analysis measures effects of the proposed critical-habitat designation on in-water and nearshore construction, activities that contribute to water pollution, military activities, energy projects, aquaculture and mariculture, environmental response activities, and federally managed fisheries.
- Spreading navarretia (*Navarretia fossalis*), California. The analysis measures effects of the proposed revised critical-habitat designation on urban development, flood-control facilities, water service pipelines, public lands management, and transportation.
- Northern spotted owl (*Strix occidentalis caurina*), Oregon, Washington, and California. The analysis measures effects on timber harvest, salvage of dead trees from healthy forest stands, and post-wildfire burn areas; snag creation or removal; hazard tree removal; fuel-reduction treatments; wildland fire management and fire-suppression activities, such as back-burning and felling trees; personal use and commercial firewood collection; land-disturbing activities associated with construction and maintenance of power transmission line corridors, highways, hydroelectric facilities, mines, or oil, gas, geothermal, or telecommunications leases; sand, gravel, or rock extraction; and construction of ski areas and associated resort facilities or other large-scale recreational developments on U.S. Forest Service and Bureau of Land Management lands.
- San Bernardino bluegrass (*Poa atropurpureai*) and California taraxacum (*Taraxacum californicum*), California. The analysis measures effects on urban development, nonnative/invasive species management, recreation, livestock grazing, mining, habitat conservation planning, public lands management, and transportation.
- San Diego thornmint (*Acanthomintha ilicifoliai*), California. The analysis measures effects on recreation, nonnative/invasive species management, urban development, public and nongovernmental organization conservation activities, habitat conservation planning, and mining.
- Nevin's barberry (*Berberis nevinii*), California. The analysis measures effects on urban development, water and lake level management, BLM and USFS lands management (fire management and nonnative/invasive species management), habitat-conservation planning, transportation, and recreation.
- Salt Creek tiger beetle (*Cicindela nevadica lincolnianai*), Nebraska. The analysis measures effects on land development, public and NGO conservation activities, habitat-conservation planning, transportation and public works projects, agriculture, and livestock grazing.
- Kootenai River population of white sturgeon (*Acipenser transmontanus*), Montana and Idaho. The analysis measures effects on agriculture, recreation, dam and reservoir operations, hydropower production, fish hatchery operations, and flood-control facilities.

## Benefits and Costs of Proposed Arctic Regulations, Shell Alaska Venture – Alaska

**Economist**—The Office of Information and Regulatory Affairs, a division of the Office of Management and Budget, was tasked with the review of new rules promulgated by regulatory agencies. Ms. Ahmed was part of the team that prepared a benefit-cost analysis of three elements of the proposed rule having to do with additional security surrounding oil spill response. Benefits were estimated by using spill probabilities and reduced risk of harm to the ecosystem services provided by the natural environment. The team also analyzed the degree to which the proposed arctic regulations were consistent with international arctic regulatory trends.

## Water Resource Management

### Nature-Based Adaptation to Climate Change, The Nature Conservancy – Ventura County, California

**Environmental Economist**—Ms. Ahmed was part of a larger team working with The Nature Conservancy as part of their Coastal Resilience Ventura project to evaluate alternative climate change adaptation strategies. The goal of the project was to analyze all economic costs and benefits of nature-based and engineering-based adaptation alternatives for Ventura County. The approach used changes in the ecosystem service levels for both alternatives, including habitat, recreation, and erosion prevention. The built environment was evaluated for flood and hazard damages in dollar values, using standard damage functions and hazard forecasts, including storms, rising tides, wave damage, and erosion. The results will be contained in an on-line map so that stakeholders can see which kinds of adaptation are needed where. Results are also available in a user-friendly spreadsheet tool that allows decision makers to vary input assumptions in the benefit-cost decision. The team worked closely with stakeholders representing city governments, state agencies, emergency managers, and the U.S. Navy. In addition to working on the analysis and documentation, Ms. Ahmed provided literature reviews on various economic climate-change-evaluation tools and approaches to estimating baseline conditions.

### Water Rights Review for Recreational Properties with High Water Use, Confidential Client – 16 U.S. States and Province of British Columbia, Canada

**Environmental Economist and Water Resources Specialist**—As a key member of a multidisciplinary team of natural resource economists, hydrogeologists, and water resource managers, Ms. Ahmed worked with the client to analyze water rights and security at various recreational properties with high water use across the U.S. (Arizona, Arkansas, California, Colorado, Florida, Hawaii, Maine, Massachusetts, New Hampshire, New York, Oklahoma, South Carolina, Texas, Utah, Vermont, and Washington State) and in British Columbia, Canada. The study identified the risks (potential and actual) associated with water supply at the facilities and assigned water security scores to the properties. The water security scores reflected current water use, availability of alternatives for water use, relevant laws and regulations, governing authority for water supply, drought and changing weather patterns, and facility expansions. Trends in water availability were forecast, given changing climatic conditions, economic growth, population growth, facility growth, regulatory changes, and instituted or planned drought restrictions. In areas where drought is a threat, Ms. Ahmed examined the main triggers for drought restrictions; which entities have the authority to impose actions such as water-use restrictions; and what regulations and protocols are in place to govern these actions. Finally, she assisted with the completion of additional in-depth analyses of water rights security for especially at-risk properties in California, projecting water needs and forecasting availability.

### Water Resource Review for Brewery Operations, Confidential Client – California

**Environmental Economist and Water Resources Specialist**—Ms. Ahmed was a key member of a multidisciplinary team of natural resource economists, hydrogeologists, and water resource managers who worked with the client to analyze water resource security for a beverage manufacturer in California. The study identified the risks associated with recurring drought conditions as well as other factors. The analysis reviewed how water is appropriated and managed, including assessing the hierarchy of relevant state and local laws and regulations, governing authority for water supply, regulatory uncertainty, and how drought conditions affect the water supply and water rights (current and long-term). In addition, the team identified alternative water



supply options and conducted interviews with key personnel from the brewery and the water provider. Finally, the team provided the client with a clear summary of findings and an assessment of water security for future operations, especially considering changing climatic conditions and regulations.

## **Water Supply Risks Associated with Facility Expansion, Confidential Client – Oklahoma**

**Economist and Water Resources Specialist**—Ms. Ahmed assisted a confidential client in identifying the water supply risks associated with expanding a facility in Oklahoma. The analysis included a review of how water is appropriated and managed at the current and potential new locations, all relevant state(s) laws and regulations governing authority over the water supply, water rights and water management, and interstate compacts and several agreements. The study also identified historical periods of low flows in the area and looked into the reasons behind these, including, but not limited to, dam management and droughts. In addition, Ms. Ahmed reviewed standard practices for municipalities, agriculture, and industrial facilities facing drought conditions, and explored whether mandatory water rationing has a legal or traditional precedence. Specifically, she examined the main triggers for such actions, what entities have the authority to impose actions such as water-use restrictions, and what regulations and protocols are in place to govern these actions. Finally, she provided the client with a list of options for securing more reliable water supplies for the current and proposed locations.

## **Water Infrastructure Investment Analysis, State of Washington Office of Financial Management – Washington**

**Environmental Economist and Facilitator**—Ms. Ahmed was key member of the team conducting an analysis for the Washington State Office of Financial Management of the economic implications related to water infrastructure and fisheries habitat restoration needs in Washington, considering changing population, climate, land use, and demand. Through a review of existing data and literature, in addition to an extensive stakeholder outreach process, the team developed a 20-year forecast of investment needs in water supply, flood protection, stormwater management, and fisheries habitat restoration across the state. From the results of the literature review and stakeholder outreach process, the team of economists estimated the effects on the Washington economy as a result of investing—and not investing—in water infrastructure projects, at the water basin level and by project type. Particular attention was paid to projects resulting in multiple benefits and prioritizing green over traditional grey infrastructure. A regional economic impact assessment conducted using IMPLAN considered the impact of investment on water-dependent sectors, employment, and economic output. The final report was presented to the Washington State Legislature.

## **Valuation of a Quarry, Based on Water Storage Potential, Confidential Client – Indiana**

**Environmental Economist and Water Resources Specialist**—Ms. Ahmed worked on a project involving appraisal of a quarry in Indiana in three different capacities: for its water storage potential, in terms of any remaining mineral resources, and for any other uses such as a landfill. This quarry is the subject of condemnation proceedings for the purpose of constructing a highway. A nearby city is interested in using the quarry pit as a raw water storage facility in order to ensure sufficient future water supplies for the city. The appraisal of the property and its associated mineral rights and other potential uses will be important in determining the overall value of the property, based on its highest and best use. In addition, Ms. Ahmed developed a value for the property, based on its potential for water storage using the least cost alternative method.

## **Valuation of Grays Harbor Public Development Authority Water – Grays Harbor, Washington**

**Project Manager and Environmental Economist**—Ms. Ahmed conducted a water valuation study for the water right held by the Grays Harbor PDA for leasing to a natural-gas-fired, combined-cycle combustion turbine power plant at the Satsop Development Park in western Washington. This power plant was formerly a partially constructed nuclear power plant that was acquired by the current owner in 2005. The owner plans to double the present 650-megawatt capacity of the plant, which would require additional water. The analysis involved, but was not limited to, developing/updating a detailed database of water transactions in Washington and identifying transactions involving water with similar characteristics; interviewing the various stakeholders as well as potential buyers for the water right; articulating the restrictions on the subject water, based on water

laws and policies; and examining options for developing alternative supplies and/or acquiring new water rights. In addition to estimating the value of the water itself, a financial model was developed and provided to the PDA to facilitate the negotiation process. This model helped the PDA to quickly assess the different contract terms proposed, such as the timing and quantity of water, during discussions with the lessee. Ms. Ahmed was also directly involved in the negotiation process between the PDA and the lessee, and conducted further analyses as required.

### **Valuation of Olympia Brewery Water Rights, R.E. Loans, Inc. / Bar-K, Inc. – Washington**

**Environmental Economist and Water Resources Specialist**—Ms. Ahmed evaluated the water rights associated with Olympia Brewery in western Washington. The analysis involved developing a detailed database of water transactions in Washington and identifying transactions involving water with similar characteristics; interviewing the various stakeholders as well as potential buyers for the water right; articulating the restrictions on the subject water, based on water laws and policies; and estimating the cost of developing alternative supplies and/or acquiring new water rights.

### **Valuation of Water Right Held by Weyerhaeuser Company in Tokul Creek for the City of Snoqualmie – Washington**

**Environmental Economist and Water Resources Specialist**—Ms. Ahmed carried out a study for the City of Snoqualmie to value a water right held by Weyerhaeuser Company in Tokul Creek, a tributary of the Snoqualmie/Snohomish River. The city is in ongoing negotiation with Weyerhaeuser regarding purchasing the subject water right; the project, in support of this negotiation effort, involved conducting a comparable-sales analysis in order to estimate the value of the water right.

### **Enloe Hydroelectric Project Federal Energy Regulatory Commission License Application, Okanogan Public Utility District – Okanogan County, Washington**

**Environmental Economist and Water Rights Specialist**—Ms. Ahmed was part of the team retained by the Okanogan PUD No. 1 to lead the development of a license application to the FERC for the Enloe Project, a small hydroelectric facility on the Similkameen River, near the Canadian border in north-central Washington. The team is leading the preparation of a new license application and conducting consultation and permitting. In addition to other tasks, Ms. Ahmed identified and assessed all the existing water rights in the vicinity of the project, especially in terms of suitability for the project. Following this, she prepared a complete application package on behalf of the PUD to apply for new water rights and a change in the point-of-diversion of an existing PUD water right for the project. The process involved working closely with the state Department of Ecology.

### **Water Management Plan (resulting from a Cumulative Impact Assessment), Solar Photovoltaic Power Generation, Honduras, Confidential Client**

**Economist and Water Resources Specialist**—Ms. Ahmed developed a water management plan for the development of three solar PV power plants with the aggregate capacity of 78.6 megawatts in southwest Honduras. The need for this plan was triggered through the recommendations of the cumulative impact assessment for the project. The specific tasks included assessment and review of alternative cleaning methods, including the use of dry brush cleaning; assessment of water requirements during project operations and its effects on competing uses; assessment of water balance of the area; and justification of the extent of water use on the site, considering both environmental and economic factors. The project triggers six of the International Finance Corporation's eight performance standards.

### **Valsetz Water Storage Project – Polk County, Oregon**

**Environmental Economist and Water Rights Specialist**—Polk County, Oregon, was expecting water shortages and considered construction of a water-storage facility that would capture water in the headwaters of the coastal range to provide the needed water supply. The project would include an interbasin transfer of water into the Willamette Valley. Under contract to the county, Ms. Ahmed was a key member of the team that completed a feasibility study examining the potential for building the project. The study evaluated three

different project options determined by dam and reservoir size. The FS assessed current and future water demands and determined whether each of the options would be able to meet future water needs. The study evaluated expected physical and chemical water quality parameters that would develop in the reservoir and downstream of the dam, as well as potential impacts on terrestrial and aquatic resources and cultural/historical resources. Additionally, a preliminary assessment of potential hazardous wastes on the property was completed. The results were used to assess feasibility of constructing the facility, factoring in the public need, environmental effects, and regulatory risk. Several issues related to likely impacts on anadromous fish species were identified that could make permitting of the project difficult; however, options for project operation, such as variable intake levels, were identified that may offset the impacts to fisheries. As follow up to this study, the team also completed a rapid assessment of the potential for constructing a water-storage project in an adjacent basin at a location where no fish were present. That analysis suggested that a project in the alternate location may be feasible; however, additional study would be needed to determine the feasibility of that location.

**Economic Analysis of Water Allocation Alternatives for the Gila River Indian Community – Arizona Environmental Economist and Water Resources Specialist**—Ms. Ahmed conducted an economic analysis of water allocation alternatives for the Gila River Indian Community (GRIC). She developed a database of market transactions of surface water, groundwater, and reclaimed water in Arizona, including sales, leases, and exchanges; conducted a literature review on the costs and benefits of water leases and water exchange agreements; analyzed current and future market value of off-reservation water leases and sales; articulated the water laws and policies in western states, with a focus on Arizona; examined the benefits, costs, and markets associated with banking surface water supplies in off-reservation Arizona Water Bank projects; updated irrigated crop budgets; and analyzed the market opportunities and limits for irrigated crops. These results will provide input to the GRIC Water Resource Decision Support System that will assist the GRIC in formulating a water management strategy that meets short-, intermediate, and long-term community goals and objectives.

### **Evaluation of Central Arizona Project Water/White Mountain Apache Tribe Water Right Claim – Arizona**

**Environmental Economist and Water Resources Specialist**—Ms. Ahmed carried out a detailed water valuation study of CAP water in Arizona. She developed and updated a database of water transactions in Arizona, including surface water, groundwater, and reclaimed water; studied and articulated the western water laws and policies, with a focus on Arizona; analyzed the demand and supply of water in the state; interviewed potential buyers/lessees (e.g., city and state governments, developers/builders, water investment firms, utilities); and estimated current and future market value of CAP water leases and sales. The market value of CAP water was analyzed for both long- and short-term transactions, and was based on, among other factors, historical water transaction data, specific examples of relevant recent transactions, dependability of the type of CAP water (priority), and current and future water demand.

### **Reserved Water Rights for the Crow Indian Reservation, Bureau of Indian Affairs, Rocky Mountain Regional Office – Montana**

**Economist**—Ms. Ahmed is part of a team that serves as technical coordinator for multidisciplinary study of water rights, ongoing since 1995. Tasks include analyzing the economic feasibility of a comprehensive water right claim plan, including a detailed analysis of farm enterprises. Ms. Ahmed has been involved with developing, conducting, analyzing, and documenting a survey to assess the feasibility of growing poplar on the Crow Indian Reservation.

### **Little Colorado River Basin Adjudication Support, U.S. Department of Justice and U.S. Bureau of Indian Affairs – Navajo Indian Reservation, Arizona, New Mexico, and Utah**

**Environmental Economist**—Reconciling water right claims throughout the southwestern United States is a considerable challenge. Many river basins are currently undertaking adjudication actions to quantify the related water rights. Ms. Ahmed is part of a team that has been providing support to the DOJ and the BIA in the Little Colorado River Basin adjudication for many years. The team is currently assisting the federal team by developing

a long-term population projection for the Navajo Nation. Water rights for Indian reservations are to cover all water demand “in perpetuity.” This population projection is being used to forecast future domestic, commercial, municipal, and industrial water requirements. The team gathered data from a wide variety of sources, including publicly available data and information provided by the Navajo Nation. The team will also provide expert witness services as needed for settlement and litigation processes.

## Economic and Financial Analysis

### Natural Resource Damage Assessment, Confidential Client – Gulf Coast

**Environmental Economist**—Ms. Ahmed was actively involved in analyzing the results of human use surveys in response to potential recreation damages in the Gulf of Mexico. Information collected will be used to establish baseline recreation conditions in the affected region and recreational losses resulting from the damages. Ms. Ahmed was the primary team member conducting the quality assurance/quality control and authentication of the survey data. She also conducted a thorough review of literature on travel costs related to water-based recreation. In addition, Ms. Ahmed provided assistance in organizing the field teams and preparing the materials needed for surveys.

### Litigation Support for International Natural Resource Damage Assessment, Confidential Client – Latin America

**Environmental Economist**—Ms. Ahmed provided economics support for an NRDA litigation process in Latin America. The case involved alleged charges of deforestation and environmental contamination in a tropical rainforest. Ms. Ahmed worked with a team to examine the macroeconomic and human development impacts. Her evaluation used the United Nations Development Program’s Human Development Index as one of the metrics. Ms. Ahmed also carried out a detailed literature review of existing documents on macroeconomic policies in the region and on the history of the project.

### Forecasting Electric Vehicle Purchases in the Newhall Ranch Community, the Newhall Land and Farming Company and Ramboll Environ – California

**Environmental Economist**—Ms. Ahmed was part of a team that analyzed how incentives, including financial purchase subsidies and charging infrastructure, were expected to accelerate the conversion to electric vehicles in the vehicle fleet operated by the future residents of the Newhall Ranch planned community. The analysis was based on economic principles of demand; i.e., people make purchases based on price, their income level, the price of substitutes (in this case, an Internal Combustion Engine Vehicle), expectations, and a variety of tastes and preferences. The approach to analyzing the impact of the incentives involves first establishing the number of ICEVs expected to be purchased by the community’s residents without any additional incentives. The same kind of forecast was then developed for the population with the incentives in place. The difference between the two forecasts may be considered the result attributable to the incentives. The work was part of a greenhouse gas emissions technical report developed for the Newhall Land and Farming Company.

### Regional Economic Impacts of Wind Power Development – Harney County, Oregon

**Economist**—Ms. Ahmed was part of the team that conducted the analysis of the economic impact of two proposed wind power projects in Harney County, Oregon, on behalf of wind energy developer Columbia Energy Partners. Sources of project impacts evaluated include construction jobs and local material purchases, wind turbine operation and maintenance jobs, lease payments to landowners, increased tax revenue, and potential effects on property values and recreation. In addition to collecting data from project developers and operators, the research included extensive interviews with local service and retail businesses, government officials, and community organizations, culminating in an estimate of the increased income and jobs directly due to the project.

## Impacts to California Agricultural Economy from Reduced Delta Water Exports Due to Delta Smelt – California

**Economist**—Ms. Ahmed was part of the team that analyzed the economic impact of proposed reductions in water supplies to California agricultural districts south of the Sacramento-San Joaquin Delta. The study was carried out for the Western Growers. Supply reductions are proposed in order to protect the delta smelt, an endangered species protected under the Endangered Species Act. Ms. Ahmed assisted in analyzing the proposed actions to estimate the economic impacts of reduced irrigation water supplies to all California agricultural districts south of the delta that receive water through the Central Valley Project and the State Water Project. Based on projected water supply reductions to each irrigation district, the analysis estimated total reduced agricultural output under one-year and permanent water supply reductions for dry and average water year types. Ms. Ahmed conducted interviews of personnel for the various water districts and other stakeholders.

## Economic Study of Recycling for Colorado Department of Public Health and Environment – Colorado

**Environmental Economist**—Ms. Ahmed is part of the team identifying the economic impacts to Colorado from waste diversion in the state. The project includes data collection through directed research, interviews, and surveys, as well as the economic impact assessment using IMPLAN, an input-output software. The direct, indirect, and induced economic impacts resulting from the recycling, composting, remanufacturing, and reuse industries are expected to include the quantity and variety of recyclables available for local remanufacturing, and to which industries these materials would be applicable, the number of jobs created by geographic area, the number of jobs created by industry sector and material type, the number of jobs in the industry, and the average wages of each job type. In addition to the modeling, Ms. Ahmed will develop an analysis of the potential for job creation, based on increased diversion, local and state tax revenues, and potential for increased revenues based on increased diversion.

## Recycling Economic Analysis for Salt Lake County, Salt Lake County and Ramboll Environ – Utah

**Environmental Economist**—The recycling industry comprises a large number of firms in several business sectors. Recently, many cities, counties, states, and regions have begun measuring the economic impacts of their recycling sectors, as well as looking for ways improve policies and regulations to support the recycling industry. Ms. Ahmed is part of a team that is providing economic impact analysis for the recycling industry in Salt Lake County, Utah. This project includes gathering and compiling publicly available data; developing a survey and interviewing industry participants to gather additional data; and using IMPLAN software to analyze the direct, indirect, and induced economic impacts in the study area of the county. The team also reviewed and assessed documents and data provided by the county to aid in the development of recommendations for improving recycling efforts in the county and decrease waste (alternatively increase recycling). In addition, the team relied on interviews and survey results from industry participants to develop the recommendations presented to the county.

## Analysis of Utah Lake Carp Disposal Options for Utah Department of Natural Resources, Utah Lake Commission, and June Sucker Recovery Implementation Program – Utah

**Economist and Deputy Project Manager**—Ms. Ahmed conducted an analysis of options for removal and disposal of common carp from Utah Lake. The study was part of the joint efforts of the Utah Lake Commission and the JSRIP to coordinate the removal of carp from the lake. The study looked at financial and ecological feasibilities of two options: removal and disposal of carp at local landfill(s)/composting facility(ies), and removal and conversion of carp into marketable fish meal through the development of a fish meal processing plant at the lake. Ms. Ahmed conducted a traditional financial feasibility analysis of the two options. This was followed by a deeper analysis of the ecosystem service values associated with each option and development of a more in-depth assessment of benefits and costs by incorporating environmental gains and losses into the economic decision making.

## **Cabrillo Port Economic Effects – Ventura County, California**

**Economist**—Ms. Ahmed assisted in the analysis of the impacts on the local economy from construction and operation of a floating storage and regasification unit offshore of Ventura County, California. The project, known as Cabrillo Port, will result in money being spent in the local economy of Ventura and Los Angeles counties. The IMPLAN input–output modeling software was used to estimate how the money spent on construction wages and the purchase of construction materials and services will move through the local economy and increase total economic output, labor income, and employment.

## **Business Plan for Self-Sustaining Finances, Valles Caldera National Preserve – New Mexico**

**Economist**—The Valles Caldera National Preserve is a unique institution with both public and private ties. The preserve is required by a congressional mandate to become a financially self-sustaining entity by 2015. Ms. Ahmed was part of the team that developed a business plan, including market and financial analyses of three alternatives that will enable the preserve to reach its self-support goal. The business plan included revenue projections for proposed lodging, retail, research facility, and recreation programs at the preserve. Ms. Ahmed led the effort to estimate the construction costs of the various proposed facilities. The analysis was based on interviews with builders and developers and available literature and estimates.

## **Economic Impact of Tobacco-Harm Reduction, Confidential Client – USA**

**Economist**—Ms. Ahmed was a key member of the team assisting in developing estimates of health care costs and cost savings related to tobacco-harm-reduction strategies. She worked in coordination with other team members in developing a model to estimate changes in life tables related to tobacco-harm reduction.

## **Published Papers and Presentations**

Ahmed, Rabia, April 2015, “Chars—the River Islands of Bangladesh,” American Water Resources Association (AWRA)—Washington Section, USA, March-April 2015 Newsletter.

Ahmed, Rabia, Aqsa Khan, and Mujeeba Batool, July 2002, “Situational Analysis of Sexual Harassment at the Workplace,” Alliance Against Sexual Harassment at the Workplace, Islamabad, Pakistan.

Jatoi, Iqbal, and Rabia Ahmed, 2000, “Rural Water Supply Schemes: Case Studies of Haripur and D.I. Khan,” ActionAid, Islamabad, Pakistan.

## **Work Experience**

### **7/2018–Present**

Seattle, WA, USA

Principal Economist/Managing Partner, Greene Economics. LLC

### **5/2017–6/2018**

Seattle, WA, USA

Senior Economist, Maul Foster & Alongi, Inc.

### **10/2011–3/2017**

Seattle, WA, USA

Senior Economist and Manager, Ramboll Environ

### **9/2005–9/2011**

Portland, OR, USA

Senior Economist and Project Economist, Cardno ENTRIX, Inc.

### **4/2005–6/2005**

Portland, OR, USA

Lecturer, Department of Economics, Portland State University

**9/2002–8/2004**

Portland, OR, USA  
Graduate Assistant, Department of Economics

**1/1999–2/2002 (then part-time until 9/2005)**

Islamabad, Pakistan  
Senior Program Officer—Research, Monitoring, and Evaluation and Labor Rights, ActionAid, Pakistan Country Office

**2/1998–12/1998**

Abbottabad, Pakistan  
Consultant—Research, Monitoring, and Evaluation, Sungi Development Foundation

## **Geography of Experience**

India, Bangladesh, Pakistan, Ecuador, Honduras, Bolivia, Malawi, Canada, United States of America