PLANTIERRA

John B. Dickey, Ph.D., CPSS

Principal Soil Scientist and Agronomist, Principal and Owner of PlanTierra LLC

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Education and Training

Ph.D., Soil Science, Purdue University, 1990

M.S., Agronomy, University of California, Davis, 1986

B.S., International Agricultural Development, University of California, Davis, 1979

Professional Registrations

Certified Professional Soil Scientist – American Registry of Certified Professionals in Agronomy, Crops and Soils (#03223)

Professional Organizations

- American Society of Agronomy
- Soil Science Society of America
  - Soil Science Industry Award, 2007
- National Society of Consulting Soil Scientists
  - President, 2002
  - Board of Examiners, 2003-2005
  - Board of Directors, 1996-1999
  - Education Committee, 1995, Chair 1996

Distinguishing Qualifications

Expert/Specialist in the following areas:

- Fate of water, salts, trace elements, and nutrients in surface and subsurface return flows
- Water and soil quality analyses for irrigation
- Crop and cropping system suitability for various irrigation and management regimes
- Analysis, reclamation, and revegetation of saline, sodic, and saline/sodic soils
- Documentation of cropping system environmental performance
- Regulatory (water and air quality) liaison and negotiations
- Land management evaluation; cropping and farming system analysis and farmer outreach
- Clear and useful technical communications for wide range of audiences
- Water conservation
- Assessment, stabilization, and revegetation of erodible, eroded, and otherwise degraded lands
- Experienced expert witness
- Nutrient management in crop and soil systems
- Irrigation return flow monitoring and assessment
- Watershed management
- Reuse of wastewaters and biosolids
- Phytoremediation and bioremediation
- Soil ecology
- Research and extension (12 years)

Relevant Experience

Dr. Dickey is a Principal Soil Scientist and Agronomist with PlanTierra LLC, which he established in 2010 to continue to work with agricultural, industrial, municipal, and environmental project partners on challenging land, vegetation, air, and water resources projects, mainly in California's Central Valley and Eastern Sierra. Before founding PlanTierra, Dr. Dickey and four colleagues formed and grew NewFields Agricultural & Environmental Resources, LLC to 17 staff from 2007 to 2010. Dr. Dickey's project teams there provided many clients with innovative soils, agronomic, ecological restoration, and geospatial services. Dr. Dickey was the Global Agricultural Services Leader for CH2M HILL, where he worked for 15 years. At CH2M HILL, Dr. Dickey coordinated a network of more than 60 agricultural engineers and scientists, applying these disciplines to a wide range of projects involving plant, soil, water, and land management. Dr. Dickey was a Visiting Assistant Professor at Purdue University, posted in Burkina Faso on the Agricultural Research and Training Support Project from 1992-94. He has served as consultant to the U.S. Peace Corps in Sierra Leone, to U.S. AID and the National Institute for Agricultural Study and Research in Burkina Faso (West Africa), and to Beijing Municipality. He was a Peace Corps Volunteer in Burkina Faso.

Dr. Dickey brings experience in environmental science consulting in the western United States, as well as in agricultural research, extension, production, and consulting in California, Indiana, Burkina Faso, and China. His technical proficiencies include assisting parties with planning and development of functional air and water quality regulatory requirements and programs, stabilization of large, arid land surfaces, modeling root zone processes (hydrologic, salt, and nutrient balance; ecological relationships), reuse and land application of solid and liquid wastes (municipal, animal, food processing, landfill leachate, fertilizer production), bio/phytoremediation of contaminated soils, land and watershed management, non-point source pollution control, water quality evaluation, cropping systems analysis, irrigated and rainfed agriculture, on-farm, as well as district- and basin-level salt and trace element management, irrigation, drainage, reclamation, return flow management, trace element mobility and bioaccumulation, rice production, soil ecology, soil stabilization/conservation/reclamation, water conservation, and site evaluation. He has also provided formal and on-the-job training in crop production, cropping systems, and research planning, research data management, and statistical analysis. Dr. Dickey is fluent in English and French, and also speaks Mooré, the language of the Mossi of Burkina Faso.

Representative Project Experience

Experience categories described include the following:

- Salinity, Nutrient, and Trace Element Management
- Irrigation and Drainage; Water Quality
- Wastewater Reuse and Land Application
- Agricultural Research, Extension, and Production
- Strategic and Master Planning, Negotiation, Expert Witness
- Land Management, Land Stabilization, Dust Mitigation, and Habitat Creation
- Watershed Management
- Water Conservation

Salinity, Nutrient, and Trace Element Management

(see also "Irrigation and Drainage; Water Quality")

- **Management Practices Evaluation Program (MPEP) Workplan and Funding, South San Joaquin Valley (SSJV) MPEP Committee**. Formed and leads a team of experts, spread across 8 firms, to work with the Committee, which is composed of 7 water quality coalitions stretching from Fresno to Bakersfield, to develop and implement an MPEP, as required under the Long-term Irrigated Lands Regulatory Program (LTILRP). Coordinates with agencies (USDA, UC, CSU, NRCS, Regional Water Board, State Water Board, Department of Food and Agriculture) and with other water quality coalitions (six other LTILRP coalitions and the Dairy industry) to ensure broad understanding, sharing of information, coordination, and acceptability of the work. Produced a draft workplan in 6 months, gaining final approval in 15. Wrote successful grant proposals to fund

$4 million (half grant funds, half in-kind match) in outreach, analysis, and research activity to expand the use of agricultural practices that are protective of groundwater quality, and to quantify and document improvements in performance at the landscape level, and $225k for research on rates of N removal in crops.

- **Management Practices Evaluation Program (MPEP) Implementation, South San Joaquin Valley (SSJV) MPEP Committee**. Leading diverse team of agricultural scientists and engineers, grant writers, hydrogeologists, to implement the SSJV MPEP Workplan. Work includes technical leadership in implementing a 3-year, $4.3 million program, including close coordination with research and outreach partners at UCCE, CDFA, and NRCS, leadership of a modeling team that is developing a Central-Valley-wide, landscape-level model of percolation through root zones and the fate of applied nitrogen fertilizer, development and implementation of field research projects with technical partners, and outreach to growers through mailings, meetings, web-based tools, and site visits. Specific MPEP Team efforts included: 1) Analyzed grower-reported N fertilizer use information from thousands of fields and dozens of commodities to assess their agronomic significance to assist growers in making future N management decisions. 2) Worked with multiple commodity groups and processors to procure representative samples of harvested material to refine estimates of rates of N removal from irrigated fields at harvest. 3) Assessed agronomic and environmental performance of multiple suites of management practices for dozens of crops by carefully calibrating and validating ArcSWAT (Soil Water Assessment Tool) runs for the Central Valley region. 4) Developed multiple online tools and references to aid growers in making N management decisions; deployed them at agmpep.com.
- **Nitrogen Management to Protect Water Quality for various Central Valley Agricultural Clients.** Reviewed and commented on CDFA N tracking proposal and Nitrogen Management Planning Template for irrigated lands. Invited Participant of Nitrogen Management Plan Technical Advisory Work Group examining knowledge gaps with Central Valley Coalitions. Advised on 2018 revisions occasioned by update to Irrigated Lands orders.
- **Agricultural Drainage Recycling Study, San Luis Water District, Los Banos, CA.** Formed and led a technical team composed of three UCCE scientists. Analyzed suitability of surface and subsurface drainage for blending with irrigation water emanating from the Delta. Blended water is to be applied to an area where sensitive crops (almonds, melons) predominate. Determined safe blend thresholds. Project being implemented in 2017.
- **Conservation Potential of Salinity Mitigation Strategies Study, National Water Resources Institute**. With URS (prime), assessed water conservation and other economic potential of reductions in salinity in imported water. Focused on benefits to landscape irrigation.
- **Agricultural Support to Central Valley Salinity Alternatives for Long-term Sustainability (CV-SALTS) Coalition, California**. Provider of technical support (analysis, interpretation) and strategic advice to members of the CV-SALTS Coalition, mainly on matters pertaining to salt and nitrate fate and management in and around irrigated lands, and on potential technical and regulatory approaches to these pollutants.
- **Initial Conceptual Model and GIS Support; CV-SALTS; Sacramento, California.** For CV-SALTS (a stakeholder group seeking to develop tools for salinity and nitrogen management), helped develop input data and modeling for an Initial Conceptual Model (of salt, nitrogen, and water balances throughout the Central Valley), and developed a toolset for mapping crop sensitivity zones to inform narrative water quality standards to protect AGR [i.e., agricultural irrigation] beneficial uses). Solid-phase nitrogen and bulk salt inputs to irrigated lands were updated based on new literature for re-runs of a surface water hydrology and water quality model. This output was integrated with that of a regional hydrology (groundwater and surface water) model, in a structured database, to generate the balances. These zonal balances are fundamental to development of a Basin Plan Amendment for salt and nitrate, and for long-range regional planning for management of these water quality constituents.
- **Initial Conceptual Model 2; CV-SALTS; Sacramento, California.** For CV-SALTS, developed percolation, nitrate, and salinity surface loading rates for the Alta Irrigation District area. The analysis was completed by parameterizing an open-source family of crop, hydrology, and water quality models (the Soil & Water Assessment Tool) in conjunction with modelers at Formation Environmental. The unit of analysis was the hydraulic response unit, which is a unique combination of soil, climatic, and crop conditions, applied to field-level management units. Four management regimes comprising combinations of two levels of nitrogen fertilization, and two levels of irrigation efficiency, generally representing the influence of regulatory programs and shifting irrigation technology, were analyzed. At CV-SALTS request, a fifth scenario that emulated a landscape free of agricultural irrigation was also developed analyzed. Time step was daily, and analysis period

35 years. Results were summarized to 40-acre grid cells employed in a separate, steady-state groundwater model, within which long-term water quality trends, as influenced by different surface loading regimes, were projected. The approach demonstrates methodology that could be used to inform planning of salt and nitrogen management planning at the local area level.

- **Crop Sensitivity Analysis for Developing Salinity Standards; CV-SALTS Lower San Joaquin River (LSR) Committee; Stockton, California.** For CV-SALTS LSR Committee (a stakeholder group seeking to develop a salinity standard for the LSR), developed and implemented a standardized approach to relating crop mixtures in an area to salinity standards in the irrigation water supply. Explicitly considered levels of crop yield protection from water quality impacts that were proposed as policy by CV-SALTS Executive Committee. Reviewed and critiqued a steady-state model relating crop yield loss to irrigation water quality, and its application to the area by the Regional Water Quality Control Board, and worked collaboratively with their staff to adjust and interpret the analysis. Facilitated input from irrigators to balance their drainage discharge and crop sensitivity concerns, with respect to the proposed standards. Summarized input from irrigators to the Committee for incorporation into standards.
- **Anti-degradation analysis; City of Ripon, California.** In collaboration with RMC Water & Environment (RMC), developed a quantitative, annual (in biweekly intervals), salt and nitrogen source and delivery analysis for the City's non-potable water system, which is fed by supplies varying widely in quality. Uses include industrial cooling and landscape irrigation, with respective, undesirable impacts being fouling and overloading of nitrogen. The team identified blending and management scenarios that, while allowing as much supply flexibility as possible, avoid undesirable impacts, and groundwater degradation that might result from excessive loading of irrigated areas with nitrogen.
- **Montezuma Wetlands LLC.** On an historically subsided area alongside Montezuma Slough (just north of Antioch, CA, adjacent to the San Joaquin River, where dredge spoil is reused to restore tidal wetland functions, assessed soil and water conditions and modeled salt flux out of spoils and into floodwater to ensure protection of Montezuma Slough water quality upon breaching of the levee that surrounds the site.
- **Sonoma Valley Groundwater Sub-basin and Santa Rosa Plain Salt & Nutrient Management Plans; City of Santa Rosa and Sonoma County Water Agency, California.** Two, separate, but similar projects. In collaboration with RMC Water & Environment (RMC), developed salt and nitrogen source geodatabase containing salt and nitrogen loading factors for over twenty land cover classes. Employed this tool to locate likely source concentrations to help focus watershed-level salt and nitrogen source control actions.
- **Salt and Nitrogen Balances and Methodology; CV-SALTS; Sacramento, California.** For CV-SALTS, provided land use mapping, description, and parameters to surface and groundwater models. The linked land use data and models calculate salt and nitrogen balances for three study areas (each roughly one county). Irrigation, salt, and nitrogen loads to land cover classes ranging from urban to wildlands to livestock operations are represented, and the relative contribution of each to downstream loads is quantified. The calibrated and validated models are intended to serve as tools for future analyses, including development of Basin Plan amendments addressing these pollutants.
- **Development of Salinity Management Plan; Sacramento River Settlement Contractors; Sacramento, California.** Developed a long-term research plan, as well as initial assessment of salt cycling in Sacramento Valley irrigation systems. Implemented and published basin-wide salinity assessment, including water supply, soil, and crop impacts as a function of water supply quantity.
- **Senior Consultant–Aurora Organic Dairy; Colorado**. Assisted in the development of a Sustainability Master Plan for Aurora Organic Dairy. Master plan reviewed current dairy operations and, taking account of the organic dairy's specific goals, developed specific recommendations for management of water, waste streams, energy, milking facilities, and feed production.
- **Lead Consultant–National Hog Farms (NHF); Kersey, Colorado (15,500 sows producing 349,000 pigs per year on 25,000 acres).** Worked with NHF on continuous improvement of nutrient management in their state-of-the-art, 2,900-acre land application system, the point of which was to recycle wastewater and nutrients without polluting underlying groundwater. Tasks included thorough evaluation of their extensive environmental database, modification of monitoring protocols, cropping systems and farm management recommendations, modeling root zone water and nitrogen balance for individual fields, design and implementation of site-specific research on nitrogen fate in the canopy and root zone, consulting in soil

sampling, regulatory reporting, regulatory negotiation and litigation support, and expert witness (Colorado Division of Environmental Quality, Water Quality Control Division, and Air Quality Control Division).

- **Selenium Fate Transport; Imperial Irrigation District, California.** Analyzed selenium fate and transport for Imperial Irrigation District. Developed field, drain-shed, and district-wide analyses, including conceptual models and quantitative selenium balances. Developed feasible best management practices associated with planned water efficiency conservation program.
- **Development of Salt Management Program; City of Tracy, California.** Developed a salt balance and salt management program for the City of Tracy's wastewater system.
- **Management of Saline Groundwater (ALCOA; Chewalah, Washington), ashfill leachate (Marion County, Oregon), and industrial process water (Oregon Metals; Albany, Oregon).** Salinity ranged from 5,500 to 40,000 mg/L of total dissolved solids. Respectively, management measures included irrigation of pasture, irrigation of poplar with summertime salt banking in the soil profile and wintertime flushing in subsurface drains, and source control by tarping of exposed ash.
- **Development of Salt Loading for Drainage Management; U.S. Bureau of Reclamation (USBR) (San Luis Unit of the San Joaquin Valley) and Central Utah Conservancy District.** These projects involved developing quantitative subsurface drainage salt loading for regional drainage management. Also developed land retirement scheme based on production, groundwater quality (salinity and trace element concentrations), and soil drainage conditions for the San Luis Unit.
- **Saline/Sodic Soil Reclamation; City of Prineville; Chevron Oil at Point Arthur; State of California Department of Corrections at Susanville.** Evaluated a saline site heavily contaminated with oily sludge waste and developed reclamation and revegetation options for vegetative cover and closure. The evaluation was based on a field meeting with the construction and engineering contractors.
- **Salinity and Trace Element Management; CALFED.** Led the agricultural component of the Water Quality Program, including salinity and trace element management.
- **Shallow Saline Groundwater Management; United States Navy.** Assessed and provided recommendations for management of saline shallow groundwater on poorly drained outlease (Fallon Air Station) and neighboring (Lemoore Air Station) lands.
- **Salt Balance Development; Central California Wastewater Reuse Project.** Developed salt balances for reclaimed water export to the San Joaquin Valley and two coastal valley locations.
- **Stabilization Program on a Saline Lake Bed; Owens Lake Dust Mitigation Program; Los Angeles Department of Water and Power; Los Angeles, California.** Coordinated dust emissions control research at Owens Dry Lake salt playa including stabilization of the saline lake bed with chemical, vegetative, irrigation, sand fencing, moat and row, tillage, and gravel treatments. Developed strategic plan for dust mitigation program, native halophyte propagation approach, land preparation, reclamation, planting, establishment, and irrigation scheduling plans.
- **Bioavailability and Bioaccumulation of Trace Element-Rich Sediments; EPA; Spring Creek Debris Dam.** Led the evaluation of potential for bioavailability and bioaccumulation from trace element-rich sediments behind Spring Creek Debris Dam near Iron Mountain Mine (California).

Irrigation and Drainage; Water Quality

(see also "Salinity, Nutrient, and Trace Element Management")

- **Water Quality Programs for the California Rice Commission (CRC).** Worked with CRC and the Central Valley Regional Water Quality Control Board to develop an approved Monitoring and Reporting Program (MRP), developed to meet requirements of the Irrigated Lands Regulatory Program (ILRP). This work focused on influence of rice farming on surface water quality. This MRP was one of the first of its kind, structured to meet rice farmers' regulatory responsibilities, while complementing other regional water quality programs. Results from about 20 years of historical rice pesticide monitoring were employed to focus the MRP on environmental quality questions of the greatest importance to the California public and rice industry. After implementation, served as senior consultant to the monitoring and reporting team regarding data interpretation, and to develop an efficient and effective approach to improving the quality of return flows, working with regulatory agencies to allow this to occur, and developing sound water quality policy for areas associated with rice production. As part of the Long-term ILRP (focused on groundwater quality protection), again developed a

technical approach based on an extensive regional water quality, soils, hydrographic, hydrogeologic, and land use database. Developed a conceptual model for loading, transport, and fate of applied irrigation water and nitrogen as part of a Groundwater Assessment Report to guide development of Waste Discharge Requirements, an associated MRP, and interpretation of collected data. Also supported CRC in their active participation in various other water quality processes (Central Valley Salinity Coalition [CV-Salts], The Delta Drinking Water Quality Technical Working Group, and the methyl-mercury TMDL. Author of Nitrogen Management Planning Template for rice production. Helped to design Farm Evaluation data structures and website.

- **Integrated Water Management and Reservoir Re-Operation: Demonstrating Sustainable Solutions for California Water; The Nature Conservancy.** In collaboration with RMC Water & Environment (RMC), assessed the potential to employ existing field irrigation facilities during the wintertime to augment surface recharge of depleted groundwater in Sacramento County. Underlying geologic, soil, cropping and irrigation system, and irrigation facilities factors were investigated, and a collaborative pilot program with selected irrigators was recommended.
- **Evaluating the Effect of Cold Water on Rice Production; Western Canal Water District, Richvale Irrigation District, and Biggs West Gridley Water District; Butte County, California.** Developed the technical basis for estimating the agronomic and economic loss associated with irrigating rice with cold water on about 100,000 acres. Negotiated the technical protocol in a Settlement Agreement defining the method for determination of reimbursement to Districts by purveyors of the cold water. Served as Senior Consultant to the Settlement Agreement implementation team in developing monitoring and loss calculation protocols, designing monitoring, and assessing yield loss.
- **Irrigation Land Evaluation; Uintah Basin; Utah and Blackfeet Reservation; Montana.** Participated in evaluation of lands for large irrigation project designs in the Uintah Basin, Utah, and on the Blackfeet Reservation, Montana. Studies included land classification, trace element and drainage studies, inventory of current land use, identification of potential wetlands mitigation sites, and farmer contact.
- **San Francisco Bay Delta Restoration; CALFED.** Provided technical support to the CALFED (in concert with many federal and other state water and environmental agencies and stakeholders) in an effort to remediate the San Francisco Bay Delta. Served as staff to the water quality technical team, coordinating team membership from rural (area of origin, agricultural water user, mining, and agricultural drainage) constituencies. Provided assistance with plan process and strategy, developed technical water quality databases, lists, and levels of key water quality parameters, and a program of actions to address water quality issues in the Delta.
- **Environmental and Conservation Balance Sheet for Rice Cultivation; California Rice Industry Association.** Led a team of scientists and engineers in preparing five reports for the California Rice Industry Association. The first four reports presented the adaptation of rice culture to California's natural environment, the use of water for irrigation of rice, and the impact of rice production on water quality and wildlife. The reports were written in layman terms and were used to communicate technical information to journalists and others with little or no formal training in agriculture, water resources, or wildlife. A fifth report is an environmental and conservation balance sheet for the California Rice Industry, detailing the efforts and successes by, as well as the challenges to, the Industry in the realm of environmental stewardship. The audience was the environmental community and major clients of the Industry.

Agricultural Research, Extension, and Production

- **See "Senior Scientist–Owens Lake Dust Mitigation Program; Los Angeles Department of Water and Power; Los Angeles, California" section, above.** The research program (funded at about $2M/year) was managed and executed by Great Basin Unified Air Pollution Control District and contractors. Research addressed saline lake bed reclamation and vegetation with drip irrigated native shrubs and grasses, lake bed re-wetting, dust emissions, and dust control measure effectiveness. In this capacity, Dr. Dickey and his team coordinated collaboration with local air pollution regulatory personnel and a number of R&D contractors and subcontractors, including the University of California. One product of the research was methodology for sustainable halophytic vegetation systems for stabilizing the extremely saline Owens playa. Order 1 and 2 soil surveys were developed, as well as an innovative surface condition survey. A halophyte seed supply was

established and sustained. Plans and specifications for tillage, fertilization, reclamation, and planting were developed to produce suitable soil conditions and a viable plant stand through state-of-the-art, subsurface drip irrigation; and managed subsurface and storm drainage. Developed innovative water supply approach, including water blending and treatment to protect soil quality and irrigation system integrity in this strongly saline and sodic environment. Developed and implemented lake-wide water and salt management tools.

- **Cooperative Research Development; Chevron Chemical.** Developed and analyzed cooperative research with Iowa State University to determine the effect of fertilizer manufacturing pond water and residuals (ammonium nitrate solution and calcium phosphate solids) on soil conditions and corn production. The work demonstrated the environmental safety and fertility effectiveness that was comparable to conventional fertilizer. The material was then used to fertilize about 5,000 acres of farmland.
- **Assessment of Herbicide Drift Damage on wine grape root stock; Travelers Insurance.** Assessed the magnitude of damage for nursery wine grape root stock from an adjacent property. Prepared a technical memorandum outlining the degree of damage and expected crop losses.
- **Senior Consultant–National Institute for Agricultural Research and Study; Burkina Faso, West Africa.** Consulted the research team using aerial and satellite photography to evaluate soil conditions for plant growth and evolution of land surfaces (erosion and changes in cultivated and natural plant communities) in West African villages. Regenerative land management techniques for highly degraded lands were pilot-tested by farmers and herdsman in collaboration with the research team, and then implemented by farmers at full scale. In another project, the strategy and soil/crop/farm economic effects of indigenous agroforestry systems were researched, demonstrating how farmers can optimize land use by mixing of trees with cereal crops. Farming improvements such as soil and water conservation practices, development of very successful upland rice and forage cropping systems, agroforestry systems, and promising crop varieties were tested and evaluated by the multi-disciplinary teams in collaboration with local communities and individual farmers.
- **Assistant Maize Agronomist–Semi-Arid Food Grain Research and Development Project; Kamboinsé; Burkina Faso, West Africa.** Conducted research on corn planting date, density, fertilization, seedbed preparation, tillage, cultivation frequency, crop rotation, intercropping, and pest management. Served as farm manager at the research station with primary responsibility for assembly, maintenance, and management of tractors and tools, as well as management of all mechanized field operations. Also initiated both researcher- and farmer-managed on-farm experimentation programs.
- **Independent Contractor–Sierra Leone, West Africa.** Evaluated Peace Corps programs in Sierra Leone and identified opportunities and strategies for Peace Corps' "Africa Food Systems Initiative." Consulted with extension personnel on nitrogen management, iron toxicity, and cane rat control problems in rice.
- **Postgraduate Researcher–University of California Cooperative Extension.** Worked with specialists for rice, corn, and sorghum production, as well as with four county-based Farm Advisors. Corn production research focused on resistance to fungal pathogens and variety trials. Rice research focused on phytotoxicity of broadleaf herbicides to rice and the effects of application timing, water management, and nitrogen fertility on this toxicity.
- **Postgraduate Researcher–Indiana.** Worked at research farms throughout Indiana to define farming practices favorable to earthworm activity considered critical to the performance of reduced tillage systems (no-till, ridge tillage, and chisel tillage).

Water Conservation

- **Water Conservation Program Development; Owens Lake; Los Angeles Department of Water and Power; Los Angeles, California.** Authored a Water Conservation Program for the Owens Lake Dust Mitigation Program, coordinating water conservation planning and regulatory review.
- **Water Demand Evaluation; USBR; Monterey County, California.** Worked for the USBR to assist the Monterey County Water Resources Agency to describe cropping patterns in a GIS database of Salinas Valley farms. Also coordinated the development of a computer program to integrate information about crop water use, climate, and land use to predict net crop water demand valley-wide.
- **Development of Alternatives for Water Conservation; Fallon Naval Air Station, Nevada.** Developed and evaluated alternatives for water conservation and salt management on irrigated farmland, including summary

of costs and water savings for engineering improvements to the distribution and application systems, as well as modifications to irrigation and land management practices.

- **Drainage Recycling; Glenn-Colusa Irrigation District; Willows, California.** Evaluated soil salinity on several hundred thousand acres of irrigated land. Sampling and analysis results were compared with historical measurements by the USBR, showing a significant increase in salinity at most locations throughout the District. Salinity maps of the District were developed. The trend of salinization was analyzed for its relationship to long-term irrigation management, including a "regulatory drought" during which irrigation was curtailed throughout the District, and contemporary conservation and drainage recycling practices. In subsequent work with agricultural engineers, the team evaluated the impact and feasibility of various methods for drainage recycling within the District.

Land Management, Land Stabilization, Dust Mitigation, and Habitat Creation

- **Habitat Water Demand Model for Salton Sea (Habitat H2O), Audubon California.** Developed detailed water balance estimation tool, considering a range of biological, climatic, design, water supply, site, and operational information, generating explicit estimates of water required to maintain land wetness, vegetation, and open water; maintain salinity within acceptable ranges; and replace water lost to seepage. Working with Audubon collaborators (Pacific Institute, Torres Martinez Tribe, California Department of Water Resources, Salton Sea Authority, and Water Transfer Joint Powers Authority), augmented analysis and transferred to planning and design teams to facilitate comparison among multiple, alternative project options, and to enable accurate estimation of habitat water requirements. Assisted with integration of habitat, water supply, and dust mitigation goals for the Salton Sea.
- **Senior Consultant–Owens Lake Dust Mitigation Project; Los Angeles Department of Water and Power; Los Angeles, California.** Coordinated liaison with research and development for the Los Angeles Department of Water and Power regarding PM_{10} emissions control measures for the Owens Dry Lake Bed (see "Agricultural Research, Extension, and Production" section, below). Developed strategic plan for Owens Lake Dust Mitigation Program, including dust suppression on more than 30 square miles of saline lake bed to be executed over a seven-year period. Developed salt management concepts and criteria for dust mitigation facilities. Oversaw program research and development (R&D), remote sensing, GIS, environmental and dust control measure compliance monitoring functions. Provided critical scientific input to environmental documentation, permitting, design, construction, operations, and water and air quality regulatory components of the program. Senior consultant to Managed Vegetation operations team during startup/establishment, and long-term operations. Developed and negotiated water quality permits that proactively define eco-risk associated with high-strength irrigation and drainage waters. Successfully proposed new regulatory criteria to the air district for vegetative dust control. Supported negotiation of new compliance monitoring methods, dust control measure performance requirements, dust control area delineation, and future management of dust control facilities. Drafted regulatory language allowing for flexible site management in the future, including new dust control measure development and implementation. Evaluated long-term cost implications of implementing more water-efficient dust control. Member of negotiating team that developed the 2006 Settlement Agreement between the City of Los Angeles and Great Basin Air Pollution Control District, seeking to close in on the completion of future dust mitigation. Worked with a panel of outside experts to refine dust source identification protocols employed on Owens Lake during 2008-2009. Program successfully mitigated dust emissions on over 38 square miles by the end of 2010. Was senior consultant to teams developing innovative Moat and Row (dry) dust control. Authored a Water Conservation Program for Owens Lake and coordinated water conservation planning and regulatory review. Scientific liaison to Owens Lake Master Planning process, in which habitat, dust control, water conservation, aesthetic, cultural, and recreational values are to be achieved simultaneously. Developed feasibility study, finding that, with reconfigured facilities, conservation of 100% of habitat value could be achieved with less than 50% of the current applied water. Vetted this plan with habitat stakeholders and agencies to pave the way for its incorporation into the Master Plan. With the same group, developed resource protection criteria for groundwater dependent wetlands along the perimeter Owens Lake, along with protocols for their use in guiding and regulating operation of planned groundwater extraction around the dry lake. Led plant and soils support to construction management team for 1200 acres of vegetated dust control in Phase 7a and 200 acres in Phase 9/10. Supported LADWP

operations during establishment of vegetation in the same areas. Laid out new tillage dust control plans and profiles. Selected brine dust control areas and profiles for extensive conversion from water-based to waterless dust control in 2015. Drafted specifications for vegetative, brine, and tillage dust control. Designed and analyzed control efficiency studies for tillage, water-based, and vegetative dust control.

- **Expert Witness–Los Angeles Department of Water and Power; Los Angeles, California.** Expert witness for Los Angeles Department of Water and Power before the California Air Resources Board, evaluating measures to control PM_{10} emissions from a saline, dry lake bed in the western United States. Assessed the feasibility, effectiveness, and optimal use of measures such as soil wetting, reclamation and vegetation, covering with gravel, windbreaks, salt crust stabilization, and sand immobilization.
- **Air Quality Monitoring and Mitigation; Imperial Irrigation District; California.** Assisted the Imperial Irrigation District (IID) with air quality and land stabilization components of CEQA analyses for two phases of the Water Transfer Mitigation and Monitoring Program. Provided senior consulting services to IID regarding air quality monitoring and mitigation, coordinating efforts with regulatory and water transfer partners, and working on special projects. In this capacity, worked with these agencies to draft an air quality background monitoring design and to identify useful dust control pilot project opportunities. Also worked with a consortium of agency partners to develop an innovative Habitat and Air Quality Management Project, including a detailed conceptual approach that employs networked, linear habitat channels to preemptively control dust over most of the future Salton Sea Playa, creating an opportunity to greatly reduce future mitigation cost and risk of excessive PM_{10} emissions. Developed and helped implement pilot projects to test performance of land stabilization measures. Developed conceptual layouts for stabilization of emerging sea bed.
- **Salton Sea Ecosystem Restoration Program; California Department of Water Resources.** Served as lead scientist in assessing potential dust emissions from Salton Sea Playa (future exposed sea bed) and developed detailed plans for stabilizing playa. Worked extensively with local, state, and federal air quality agencies and other stakeholder groups, with the Desert Research Institute (of the University of Nevada), and with the U.S. Geological Survey to craft workable tools and plans. Developed climate-driven model of playa susceptibility to erosion. Adapted dust control methods to the unique constraints at Salton Sea Playa to serve as the planning model for playa stabilization facilities. Developed playa stabilization research plan. Consulted in development of water quality and natural water treatment features of proposed restoration alternatives.
- **Dust Emissions Evaluation; Imperial Irrigation District Water Conservation and Transfer Project; Imperial County, California.** For the IID's *Water Conservation and Transfer Project* (Imperial County, CA)*: Draft Habitat Conservation Plan, Environmental Impact Report/Environmental Impact Statement*, projected dust emissions resulting from the largest agriculture-urban water transfer in U.S. history. Land surfaces evaluated included fallowed farmland and exposed Salton Sea bed. Developed a mitigation program for dust emissions. Testified before the California State Water Quality Control Board and assisted with agency consultation (U.S. Environmental Protection Agency [EPA] Region 9, USBR).
- **Forest Land Restoration–Beijing Forest Division of International Cooperation; Beijing, China.** Worked with the Beijing Forestry Division of International Cooperation to develop a plan to stabilize, restore, and reforest degraded lands nearby to Beijing. Restoration to be achieved by a combination of reforestation, composting of municipal biosolids and food waste, and amendment of degraded lands with compost.
- **Soil Database Development–Tuscarora Gas Transmission; Oregon and California.** Developed a database of soil mapping and associated properties for rapid evaluation of soil constraints to revegetation and construction along alternative pipeline alignments for a 300-mile natural gas pipeline corridor in Oregon and California.
- **Construction Oversight; City of Roseville, California.** Supported construction oversight of the vegetated layer during closure of a 30-acre landfill facility. This support included field meetings with City, as well as construction and geotechnical contractors, to assess suitability of materials and methods for placement of the layer. Evaluations were based on laboratory and field data interpretations.
- **Riparian Zone Restoration on Santa Agueda Creek; Santa Ynez, California.** Provided a field evaluation of damaged and degraded reach; development of stabilization and revegetation design and costs. The stabilization and revegetation project was constructed in 2001.
- **Verification Methodology for Carbon Sequestration in Cornbelt Soils; Environmental Resources Trust**. Served as the Senior Scientist for a feasibility study on measuring carbon sequestration in Iowa agricultural soils to

establish tradable carbon credits for the Environmental Resources Trust. The work included development of a detailed soil sampling plan that was focused on detecting and quantifying changes in organic carbon in response to changes in soil and crop management.

Strategic and Master Planning, Negotiation, Expert Witness

- **Settlement Agreement; Cold Water Impacts to Rice in the Sacramento Valley, California.** For Richvale Irrigation District, and Biggs-West Gridley and Western Canal water districts, jointly negotiating with the California Department of Water Resources.
- **Settlement Agreement; Dust Control at Owens Lake, California.** For the Los Angeles Department of Water and Power, negotiating with Great Basin Unified Air Pollution Control District.
- **Strategic Planning; Dust Control at Owens Lake, California.** With the Los Angeles Department of Water and Power.
- **Master Planning for Multiple (Habitat, Dust control, Recreation, etc.) Benefits from Dust Control Projects at Owens Lake, California.** With the Los Angeles Department of Water and Power.
- **Strategic Planning; Water Quality Regulatory Program for the California Rice Industry.** With the California Rice Commission on various water quality programs including the Irrigated Lands Program, the Long-term Irrigated Lands Regulatory Program (adding groundwater to surface water considerations), the Drinking Water Policy Working Group (evaluating cost, feasibility, and benefits of source protection and treatment alternatives), and CV Salts (a stakeholder process for developing a Basin Plan amendment to avoid and/or address water quality degradation salt and nitrogen).
- **Strategic Planning; Air Quality Mitigation at Salton Sea, California.** With Imperial Irrigation District.
- **Strategic Planning; Beijing Green Olympics Environmental Planning, China.** With Beijing Municipality.
- **Expert Witness; Dust Control at Owens Lake, California.** For the Los Angeles Department of Water and Power before the California Air Resources Board.
- **Expert Witness; Air Quality Impacts of a Water Transfer at Salton Sea, California.** For Imperial Irrigation District before the California State Water Resources Control Board.
- **Expert Witness; Nutrient Management Impacts on Air and Water Quality, Colorado.** For National Hog Farms before the Colorado Department of Public Health and the Environment, Divisions of Air and Water Quality.
- **Expert Witness; Impacts of Beneficial Use of Recycled Water, Santa Clara Valley, California.** For Calpine before the California Energy Commission.

Selected Publications and Manuscripts

Dickey, J. 2015. Overview of CV Salts and development of salinity programs to protect irrigated crops. California Plant & Soil Conference, Feb. 4-5, 2015. Fresno, CA.

Snow, T., D. Merritt, J. Dickey, and E. Harvey. 2014. Conservation Potential of Salinity Mitigation Strategies and Realized Economic Benefits. Third International Salinity Forum. Riverside, California (pp. 147-150). June 16-18, 2014.

Kretsinger-Grabert, V. B. Dalgish, D. Boyle, J. Dickey, J. Herr, T. Grovhoug, K. Ashby, and D. Moss. 2014. Initial conceptual model of water, salt, and nitrate movement on a large scale for groundwater and surface water in California's Central Valley: Technical challenges, solutions, results. Third International Salinity Forum. Riverside, California (pp. 147-150). June 16-18, 2014.

Kretsinger-Grabert, V. B. Dalgish, D. Boyle, J. Dickey, J. Herr, T. Grovhoug, K. Ashby, and D. Moss. 2014. Two prototype area analyses for developing salt and nitrate management tools in California's Central Valley. Third International Salinity Forum. Riverside, California (pp. 147-150). June 16-18, 2014.

Kretsinger, V.; Foglia, L.; Herr, J.; Dickey, J.; Smith, R. 2009. Assessment of salt and nitrate sources and loading implications using a coupled surface water/groundwater model: a Central Valley example. American Geophysical Union, Fall Meeting 2009, abstract #H11B-0800.

Dickey, J.B. and M.F. Madison. 2004. Moving salt and water in managed ecosystems: case studies from history, and from the western United States. Development and Restoration of Mesopotamian Marshes, Harvard School of Design, October 28-30.

Dickey, J.B., M. Hall, J. Smesrud, and M. Heilmann. 2006. Irrigation of saltgrass with saline water to control dust on Owens Lake playa (in Beneficial and Nontraditional Uses of Concentrate. pp. 185. WateReuse Foundation, Alexandria, VA).

Dickey, J.B., P. Bordenave, and P. Scoles. 2004. Professional Ethics for Consulting Soil Scientists. National Society of Consulting Soil Scientists Annual Meetings. San Diego, CA, Feb 5-7.

Dickey, J.B., M. Hall, M. Madison, J. Smesrud, M. Griswold, Q. Cotten, M. Heilmann, G. Roland, J. Jordahl, R. Harasick, W. Bamossy, R. Coles, L. Wheeler, P. Brown, K. Burton, R. Fornelli, I. Anderson, M. Riedel-Lehrke, R. Tiller, and J. Richards. 2005. Managing salt to stabilize the Owens Playa with saltgrass. International Salinity Forum: Managing Saline Soils and Water: Science, Technology, and Social Issues. Riverside, California (pp. 147-150). April 25-27, 2005.

Dickey J., M. Hall, M. Madison, J. Smesrud, Q. Motte, M. Hart, G. Roland, J. Jordahl, R. Coles, K. Burton, M. Griswold, R. Harasick, T. DeVorss, and R. Prittie. 2003. Stabilizing Owens Dry Lake Surface with Irrigated Saltgrass. Air & Waste Management Association, 96th Annual Conference, San Diego, CA, June 22-26, 2003.

Dickey, J. and G. Nuss. 2002. Salinity Distribution and Impact in the Sacramento Valley. Paper submitted for US Committee on Irrigation and Drainage conference, "Helping Irrigated Agriculture Adjust to TMDLs," October 23-26, Sacramento, CA.

Dickey, J.B., F.J. Haywood. 2002. Environmental performance of a large-scale swine facility, featuring precision, direct recycling of liquid waste onto forage crops. Water Environment Federation, Animal Waste Management Conference, May 6-8, 2002, Arlington, VA.

Heilmann, Mica, B. Inman, J. Kimmelshue, B. Schmid, J. Dickey, R. Coles, and R. Harasick. 2006. Classification of the Owens Dry Lake Playa Surface Using Satellite Imagery and Unique Surface Characterization Methods. World Congress of Soil Science: Frontiers in Soil Science, Philadelphia, PA, July 9-16, 2006.

Heilmann, Mica, J. Dickey, J. Smesrud, R. Coles, and R. Harasick. 2006. Managing Salinity to Implement Vegetative Dust Control on The Saline Owens Lake Playa. 2006. International Conference on the Future of Agriculture: Science, Stewardship, and Sustainability, Sacramento, CA, August 7-9, 2006.

Smesrud, J.K., J.B. Dickey, B. Jacob, J.L. Jordahl, R.Z. Jackson, P.D. Brown, G.C. Roland, and M.F. Madison. 2004. Collection and Reuse of Extremely Saline Drainwater on Owens Dry Lake. Proceedings of the Eighth International Drainage Symposium, Sacramento, California, March 21-24, 2004 (pp. 469-477).

Smesrud, J.K., R.H. Cuenca, J.B. Dickey, and M.F. Madison. 2003. Evaporative Losses and Water Balances for Dust Control Measures on Owens Dry Lake. Air & Waste Management Association, 96th Annual Conference, San Diego, CA, June 22-26, 2003.

Selected Posters and Presentations

Dickey, J.B. 2018. *CalETa (California Actual Evapotranspiration Mapping Program) and its Uses*. Actual ET Workshop at the California Department of Water Resources. January 9, 2018.

Dickey, J.B. 2018. *Ethics for Professional Soil Scientists: How our Ethical Calls Affect Outcomes for our Organizations, Clients, and Society*. Professional Soil Scientists Association of California Annual Meeting. March 2-3, 2018.

Dickey, J.B. 2017. *Irrigated Lands Management Practices Effectiveness Research Update*. San Joaquin Valley Nitrogen Management Meeting. February 24, 2017.

Dickey, J.B. 2017. *Key Components to Preventing Nitrogen Contamination of Groundwater*. Mid-Valley Nut Show, Modesto Community College. November 3, 2017.

Dickey, J.B. 2018. *Kings River Water Quality Coalition Grower Re-certification Course: Nitrogen Management Tools for Growers & Advisors*. University of California Cooperative Extension Kearney Agricultural Research & Extension Center. March 29, 2018.

Dickey, J.B. 2017. *Managing Liability for Scientific Consulting Services: Perspective of an Agronomist Working with Water Quality Coalitions*. Plant &Soils Conference. January 31, 2017.

Dickey, J.B. 2018. *SafeSpace Information Sharing management: Increasing Implementation of Conservation Practices to protect Groundwater Quality*. The South San Joaquin Valley Management Practices Evaluation Program Committee. September 7, 2017.

Dickey, J.B. 2018. *Soil Knowledge Representation in the SWAT Modeling*. National Resources Conservation Service Meeting in Davis, CA. March 20, 2018.

Dickey, J.B. 2017. *The South San Joaquin Valley Management Practices Evaluation Program*. California Cotton Ginners & Growers Association Annual Meeting. June 2, 2017.

Dickey, J.B. 2017. *The South San Joaquin Valley Management Practices Evaluation Program (or MPEP): Focus on Assessment*. Central Valley Regional Water Quality Control Board. June 2, 2017.

Dickey, J.B. 2017. *The South San Joaquin Valley Management Practices Evaluation: New Tools and Outlook for CCAs & Growers*. California Association of Pest Control Advisers Conference. October 15-17, 2017.

Dickey, J.B. 2017. *Southern San Joaquin Valley Management Practices Evaluation Program*. Plant &Soils Conference, Collaborators' Meeting. January 31, 2017.

Dickey, J.B. 2017. *The Southern San Joaquin Valley Management Practices Evaluation Program.* California N Assessment Workshop. Hanford, CA. February 24, 2017.

Dickey, J.B. 2018. *Using Soil Survey Information: SSJV Management Practices Project*. California State University, Chico, College of Agriculture. March 1, 2018.

Dickey, J.B., K. Cassman, D. Cehrs, R. Byrnes, G. Paul, M. Sowers and T. Harter. 2018. *Connection between Nitrate in Root Zone and Groundwater as Affected by Crop and Soil Management*. American Society of Agronomy Plant and Soil Conference, February 6-7, 2018.

Dickey, J.B., K. Cassman, D. Geisseler, and C. Creamer. 2017. *Nitrogen and Dry Matter Accumulation in Peaches*. Annual Conference of the Fertilizer Research and Education Program Western Plant Health Association. November 1-2, 2017.

Dickey, J.B., K. Cassman, T. Harter, and C. Creamer. 2017. *Assessment of Almond and Orange Irrigation and Fertilization by Combining Grower Operational Records, Actual Evapotranspiration, Soil, and Plant Tissue Data*. Annual Conference of the Fertilizer Research and Education Program Western Plant Health Association. November 1-2, 2017.

Dickey, J.B., K. Cassman, T. Hartz, and D. Geisseler. 2018. *Working with Commodity Groups, Processors, and Packers to Procure Representative Crop Samples to Assess Harvest Nitrogen Content*. Annual Conference of the Fertilizer Research and Education Program Western Plant Health Association. October 22-24, 2018.

Dickey, J.B., K. Cassman, D. Holstege, R. Byrnes, and D. Geisseler. 2018. *Assessment of Harvested and Sequestered Nitrogen Content to Improve Nitrogen Management in Perennial Crops*. American Society of Agronomy Plant and Soil Conference, February 6-7, 2018.

Dickey, J.B. and D. Cehrs. 2017. *Some tools for understanding where your N is going*. Fall University of California Cooperative Extension San Joaquin Valley Citrus Meeting. November 29, 2017.

Dickey, J.B., D. Cehrs, M. Sowers, K. Cassman, and T. Harter. 2018. *Assessment of Orange Irrigation and Fertilization by Combining Grower Operational Records, Actual Evapotranspiration, Soil, and Plant Tissue Data*. California Citrus Conference of the Citrus Research Board. October 10, 2018.

Dickey, J.B., and C. Creamer. 2016. *The Southern San Joaquin Valley (Tulare Lake Basin) Management Practices Evaluation Program*. Annual Conference of the Fertilizer Research and Education Program Western Plant Health Association. October 26-27, 2016.

Dickey, J.B., C. Creamer, and A. Schmid. 2017. *The Southern San Joaquin Valley Management Practices Evaluation Program Management Online Support Tools*. Annual Conference of the Fertilizer Research and Education Program Western Plant Health Association. November 1-2, 2017.

Dickey, J.B., C. Creamer, and A. Schmid. 2018*. The Southern San Joaquin Valley Management Practices Evaluation Program Management Online Support Tools*. American Society of Agronomy Plant and Soil Conference, February 6-7, 2018.

Dickey, J.B., M.D. Hall, M. Hart, M. Madison, R. Coles, J. Castleberry, R. Harasick, T. DeVorss. 2001. *Use of diverse site characterization data for Owens Lake dust mitigation*. American Society of Agronomy Meetings, Charlotte, NC, October 20-25, 2001.

Dickey, J.B., G. Paul, T. Hartz, Y. Yimam, and T. Harter. 2018. *Quantifying Nitrate Leaching from Central Valley Irrigated Lands with the Soil & Water Assessment Tool (SWAT)*. First Annual Western Groundwater Congress. September 25-27, 2018.

Dickey, J.B., and Y. Yimam. 2018. *Soil Survey as a Water Quality Protection Tool*. California National Resources Conservation Service Planning Meeting in Chico, CA. March 1, 2018.

Dickey, J.B., Y. Yimam, T. Hartz, and K. Cassman. 2018. *Kings River Water Quality Coalition Grower Re-certification Course: Reminders from Our Nitrogen management Planning Reports*. University of California Cooperative Extension Kearney Agricultural Research & Extension Center. March 29, 2018.

Dickey, J.B., Y. Yimam, T. Hartz, K. Cassman, and J. Critchfield. 2018. *Agronomic Overview of Citrus Nitrogen Management Planning Results from the Irrigated Lands Program*. California Citrus Conference of the Citrus Research Board. October 10, 2018.

Griswold, M., J. Dickey, M. Hall, T. DeVorss, R. Harasick, and R. Coles. 2001. *Saltgrass Propagation for Large Scale Cropping System at Owens Lake*. American Society of Agronomy Meetings, Charlotte, NC, October 20-25, 2001.

Yimam, Y., G. Paul, T. Hartz, J. Dickey, and K. Cassman. 2018. *Quantifying Nitrate Leaching from Central Valley Irrigated Lands with the Soil & Water Assessment Tool (SWAT)*. Annual Conference of the Fertilizer Research and Education Program Western Plant Health Association. October 22-24, 2018.