

Science and Research

Nitrogen sources, flows, and processes (tracking the nitrogen)

- What are the relative contributors to N loading of Livestock operations compared to crops operations? Crop to crop?
- How do organic/sustainable systems manage nitrogen differently? With what differences in quality and quantity?
- What is the role of N in anaerobic systems?
- What are the mechanisms by which N application leads to GHG emissions?
- What does the science tell and not tell us about the interactions of fertilizer and water in producing nitrous oxide?
- Are there ways to “tag” nitrate/nitrogen so one can identify what source it is coming from?
- What are the implications for nitrogen flows based on the future scenarios of climate change and water availability?
- Where in the state are the major impacts of too much N? Groundwater, coastal blooms, etc? Is there a map?
- What are the synergies between conservation of N and conservation of water?
- What are non-ag sources of nitrogen and what is their contribution to nitrogen flows in CA?
- What is the N impact of motor vehicles?
- How does reactive N generated by vehicles and other combustion fit into the total assessment?
- Quantification of nitrogen flows and losses: emissions from N application, groundwater migration, consumption, other.
- Need total systems perspective of N fate – what can be controlled or not
- NO₃ sources determination
- Legacy N: cause and effect, time between use and impact.
- Impact and response to legacy N pollution, mitigation strategies
- What are the geographic areas with the greatest concentrations of N in the environment?
- What is the role of rangelands in N cycling?
- What is the contribution to N pollution of Ag compared to other sources?
- Who are the generators (sources) of N?

The science of nitrogen application

- Crop quality: N impact on
- What rules to follow: organic N, commercial N, livestock N
- Soil assessment: residual nitrogen, how much input to ensure quality crop?
- Efficiency vs. capture and reuse
- Organic N use: research, utilization, mineralization rate
- Could you define a maximum feasible NUE (nitrogen use efficiency) value for a given crop under typical Calif. conditions?
- Compost as benefit to crop
- What are the food safety implications with use of compost?
- What potential roles can compost play in: 1) Reducing need for synthetic N; 2) Reducing N offgassing during application; 3) reducing N runoff during/after fertilization; 4) stabilizing manure?
- What specific steps should a farmer take to minimize movement of NO₃ to surface water or ground water? Is appropriate guidance available for each of these steps?
- Cost of N management: by source, by method, globally to achieve and points

General science, background and research themes

- Need to consult with UC Davis researchers who study N
- What is realistic in improving efficiency, environmental performance? What's doable?
- Where are the greatest areas of environmental sensitivity to N levels and how is that sensitivity measured?
- Do N recommendations change when shifting from maximizing yield to minimizing N-use?
- Process-based N model needs to be turned into a management tool
- What is the effect of N pollution on wildlife/threatened and endangered species?
- What role does variety selection and plant improvement play in efficiently using N? (either by reducing N needed or by uptaking excess N)
- In uncertain climate conditions (change), what impact would this have on N needs for different crops/regions/etc.?
- What about N trading? N credits?
- Will the assessment include a white paper on the environmental impact of nitrogen pollution?
- How will we identify if nitrogen overuse occurs?
- Are all nitrogen sources evaluated the same?
- Is it desirable for assessment to use DWR Bulletin 160-2009 scenarios?
- Don't reinvent the wheel on N use
- Need to recognize existing research and extension work

- Feasibility of achieving endpoints: source-specific, long vs. short term, varied level of investment
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Practices

Best management practices: general

- Can composting processes lead to greenhouse gas emissions? What measures to prevent N emissions?
- What are the most effective solutions demonstrated to date for dealing with excess nitrogen?
- Disease and pest vulnerability with improper N application
- Cover crops – work both ways – pull N out and put into soil
- Risk management in N use – insurance
- What is the current state of practice in terms of BMPs with Nitrogen/nutrient management? Percent of users quantified (qualified???) in California? How could policy further data collection?
- What farming and ranching practices hold promise for nitrogen control?
- Most efficient N use application: how do you manage field and plant variability?
- Do we know enough about how: 1) amount of N; 2) form of N applied; 3) how it is applied; 4) When it is applied; affects crop yields and crop quality (e.g. keeping quality, flavor components, negative chemical profiles)
- Are UC Davis N recommendations based on current production conditions?

Water, air, and soil issues related to practices

- Nitrogen and water management
- What are BMPs that both address reduced and direct N₂O emissions and indirect N₂O Emissions via water? e.g. reduce leaching through LAND management practices
- What is optimum N application for Crop Health and to Minimize leaching to groundwater? 0.9 - 1.4 x crop uptake?!
- Which crop sectors/systems are the most inefficient in terms of N fertilizer application? Estimates regarding how much overfertilization.
- Is more outreach and demo needed to convince ag industry that the benefits of fertigation (sic) outweigh the increased cost of liquid forms of N?
- Can we find ways to reduce overall use of synthetic fertilizers?

- How can producers of excess N (dairies for example) link w/producers that could use N as a soil amendment?

General questions related to practices

- What is source of info – who does farmer trust?
- What are the ag practices most suited to conserving N? Least suited?
- What is the role of other technological work to address N impacts?
- Are there solutions to the problems raised (made apparent) by looking at N?
- Do the potential "savings" from limiting N applications outweigh the risk of reduced yields?
- What is the best way to measure N efficiency rate or use to forecast needs?
- What gaps exist in research related to impacts on yield with respect to excess or insufficient N application?
- How to measure changes in cultural practices and past/current nitrogen demands?
- How will current practices be assessed?
- What other issues could arise from inadequate or excessive N availability? Ex. excessive could increase foliar development - increased habitat for pests?
- Do University recommendations reflect the N demands of current crop production?

Policy, Economics, and Human Impact

- N impact on global warming: opportunity to \$
- Solutions need support/technical assistance
- Role of the "social" institutions?
- Social justice implications – emissions, jobs, etc.
- How to integrate competing regs!
- How are different regulatory bodies coordinating or not to address nitrogen issues?
- Endpoints for nitrogen management – air, water, economic impacts
- How might policy be used more effectively to both monitor and address non-point source N pollution from the ag sector?
- How will the work of this project tie into the implementation of AB 32 and SB 375?
- How are we going to create fiscal and other incentives for the adoption of reactive nitrogen control?
- How much are policy makers/regulators coordinated on developing a cohesive N policy that will be workable for N users?

- What are the most effective policy instruments to motivate adoption of BMPs for nutrition mgmt?
- Do solutions to N problems make economic sense?
- What are cost/benefits of NUE practices? Best way to implement these?
- How might N management tools and documentation be structured so they're appropriate for a variety of production models/systems and farm sizes?
- What are the cities' role in solving the problem of N?
- What kinds of incentives, if any are needed, would speed adoption of better N management?
- Is Ag getting the credit for current use of N?
- Are there policy options for reducing auto-based N emissions?
- What are safe levels of N in crops (tissue) for humans?
- Can some crops "super-accumulate" N to reach levels that are injurious to consumers?
- How can health impacts be integrated into evaluation of nitrate mitigation alternatives?
- What contaminants exacerbate or are impacted by nitrate levels in groundwater (Se, As, Chromium)?
- What cost-effective treatments are available for nitrate contamination of groundwater supplies?
- What would happen if we could no longer rely on fossil fuels as N source?

Communications and Outreach

- How do we communicate complexity of N system and problems to public
- What is the understanding among producers & policymakers of N impacts? And what's the gap between myth and reality?
- Are there maps showing impacts of N?
- Who are the stakeholders?
- Are there ongoing outreach efforts to positively incentivize farmers to document their N use?
- Can tools be developed for farmers to assess N-use efficiency?
- What outreach is being done to farmers regarding N and greenhouse gas issues?