Pathways to Climate Smart Agriculture in the San Diego Region of California

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Introduction/Need for the Study

In California, the San Diego region leads in cash receipts from horticultural and third in organic sales receipts (CDFA, 2022). The CDFA statistics show a combined revenue of over $1.8 billion from its products led by horticulture, avocados, oranges, lemons, grapefruits, cattle, and berries. Despite this productivity, the current and projected climate change impacts in California till the end of the century pose significant challenges (Pathak et al., 2018). These challenges include heat waves, high temperatures, droughts, wildfires, floods, variable precipitation and their associated increases in weeds, pests, and diseases pressures. This situation provides a glimpse of a volatile future, requiring multifaceted approaches to address those challenges. The objective of this study was to understand the lived experiences of farmers, ranchers, and extension service providers on a changing climate and identify education and resource needs that can help build their climate resilience practices. Our study aligns with the seventh priority of the national AAAE research agenda on preparing stakeholders to manage complex agriculture issues like climate change (Andenoro et al., 2016).

Conceptual Framework

Climate-smart agriculture is one of the vital approaches to the economic and environmental security of California (Ikendi et al., 2024; Lewis & Rudnick, 2019); guiding actions that transform agrifood systems towards green and climate-resilient practices. Farmers in California have expressed an increased need to have locally relevant and specific information on climate impacts on their farming systems and relevant adaptation resources (Jagannathan et al., 2023). Agricultural educators have supported these farmers; but they also have to deal with emerging trends related to climate change; yet they are often ill-equipped with locally relevant adaptation and mitigation resources to assist farmers (Grantham et al., 2017). A needs assessment concept is a prerequisite to developing adaptation strategies for farmers, ranchers, and technical extension service providers by understanding and documenting their experiences with climate change exposures, impacts, and social vulnerabilities (Ikendi et al., 2024). A needs assessment is also required to know what risk management practices stakeholders currently use, what tools and resources would assist them in making decisions, what types of extension education activities would help them, and where to find necessary resources on climate adaptation (Dilling & Berggren, 2015).

Methods

We founded our inquiry as constructivists seeking knowledge that is socially constructed whose meaning emerges inductively while interpreting the lived experiences of participants (Crotty, 1998). Our team conducted a focus group discussion with 10 participants (pseudo names used) that consisted of four farmers, two ranchers, and four technical extension service providers in a participatory approach, recruited through Qualtrics shared in our extension association networks. The interview guide focused on weather and climate change experiences, adaptations, barriers, and education needs. Four members of our research team participated in the interviews with multiple roles involving leading discussions, probing, audio recording, and taking notes. We followed the rules of a natural setting by welcoming our participants into the conference room at the San Diego County Farm Bureau, introducing the project goals, discussion rules, and seeking consent. Discussions lasted for 105 minutes. Recordings were transcribed, coded, and themes were developed inductively through reading the transcripts, field notes, and analytic memos (Saldaña, 2016). We shared the themes for member checks and are presented with verbatims to account for experiences of stakeholders.

Results

Stakeholders shared 11 themes relating to climate change and non-climate issues notably, wildfire, drought, high temperatures, extreme heat, reduced water availability, flooding, reduced forage, weeds, pests, regulations, and high insurance premium. For instance, Bony who has farmed for 10 years on 50 acres described the impact of high temperature and extreme heat, *in 2018, we got high heat, by 9' O'clock, it was already 100 degrees, and our grapes were drying up*. On adaptation practices, eight themes were identified including applying for government assistance, cover crops, prescribed grazing, changing labor schedules, changing grazing hours, composting, switching crops, and diversification. Mary who farms 17 acres of crops including olives, cacti, and agave said, *we started planting agave for spirits. Agave is such a resilient crop that requires very low input. We started with "tequilana", but the climate did not work, so we decided to move to other varieties. So, we are now planting cacti for the fruits*. Mike, who raises mainly beef cattle on their 12,000-acre ranch, said, *the 2017 wildfire burned all our infrastructure on the farm, but we were able to secure funding through Natural Resources Conservation Service to restore our wells. We also put up a plan for prescribed grazing, we graze along the highway first, where cows cannot graze, we mow*.

On challenges to the future of San Diego regional agriculture, seven themes emerged. In addition to climate stressors, Daniel, an extension service provider mentioned, and the team agreed on major issues like water, labor costs, regulations, price of equipment, and price of land. Kim, who has farmed for 49 years also expressed concerns that *we live in an urban environment. We have a population that does not have a clue what the agricultural community in San Diego region is contributing to their quality of life*. On educational needs, Nelly, an extension provider expressed that *a lot of people are not aware that the University of California partners with the University of Nevada on landscape mulch testing where they showed and demonstrated that the least combustible landscape is composted mulch. This mulch can conserve a lot of moisture, feed that soil, but also is less combustible*, Nelly added.

Conclusions

High temperatures and extreme heat are shortening farmers' seasons with implications on reducing yields, especially the high value specialty crops like grapes. Temperatures are also increasing the invasion and expansion of insect pests (Jha et al., 2024). Farmers, especially limited resources, are grappling with continuous switching of crops, indicating a need for information related to climate and their unique crops (Taku-Forchu et al., 2023). Related education needs were identified on the use of least combustible mulch, adaptive grazing strategy to wildfire and soil conservation. Prescribed grazing strategy is vital to support the regrowth of forage (Roche, 2016), and mowing and grazing along the highway reduces the buildup of dry matter and incidences of wildfire that starts with car accidents and leftover cigars.

Implications/Recommendations/Impact on Profession

Identifying strategic pathways to climate-smart agriculture requires understanding the experiences of stakeholders related to farming in changing climate, adaptations, and education needs. This needs assessment identified most of the common climate stressors categorized as water, temperature, and disaster related. However, non-climate issues were identified as policy and regulation. Sensitization is needed on water and economic value of cover crops (DeVincentis et al., 2022); role of agriculture in a built urban environment; and the need for collaborative efforts in extension education with the urban leadership. All these aspects of climate adaptation are relevant in planning regional and commodity-specific agricultural extension workshops.

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