# Susan E. Crow

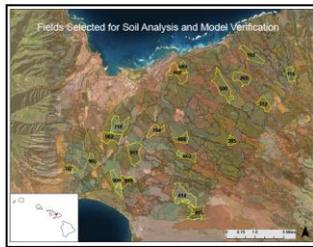*ONR Program Officer: Sharon Beermann-Curtin*

## Collect data for ALMANAC model simulations, optimization for economic and environmental sustainability
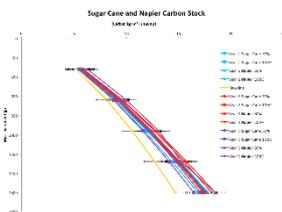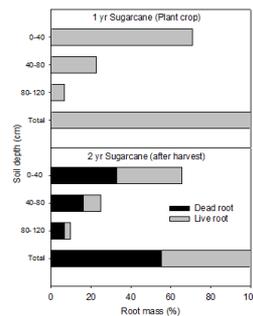
### Description

1. ALMANAC model requires field-based data for refinement and validation at the plantation scale
2. We collected field data, database manage, and link ALMANAC simulation outputs to scenarios of HC&S economic cost-benefit, including possible ecosystem service incentives



### Key Accomplishments & Findings

1. **Developed framework for linking field-validated ALMANAC simulation output to the economic cost-benefit analysis for HC&S production scenarios.**
2. Measured belowground, root response to ratoon harvest and decomposition as it relates to soil C accumulation and selection criteria for feedstocks.
3. Implemented greenhouse gas measurements and soil surveying protocols to meet data needs of the ALMANAC simulations at the field and plantation scale.
4. Multiple manuscript submitted and in the final stages of preparation for submission.

### Tools & Methods

1. Our technical approach was primary field sample collection, laboratory analyses, post-processing and calculations, and linking multiple economic, crop, and environmental models
2. Tasks included: field crop and soil parameters, soil and greenhouse gas (GHG) sampling, equipment maintenance, laboratory analysis of GHG, %C, soil chemistry, post-processing data and database management, developing and linking model outputs



### Project Management Information

Datasets are available for:
1. Baseline and annual soil carbon stock following 3 years of ratoon harvest for napiergrass, energycane, and sugarcane at three benchmark sites and one deficit irrigation trial.
2. Intensive event based and monthly monitoring $CO_2$, $N_2O$, and $CH_4$ soil flux at deficit irrigation trial and year-long validation datasets at benchmark sites.
3. 20-field validation soil dataset for plantation scale-up modeling.

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- **M.S. Thesis:**
- Daniel Richardson, NREM M.S. Plan A, Thesis option, "Microbial community response to four years of zero-tillage harvest of perennial grasses following 100 years of intensive cultivation for sugarcane", degree expected August 2017.
- Jon Wells, NREM M.S. Plan A (with intention to transfer to Ph.D.), Thesis option, "Development of a new index to predict conversion efficiency of renewable fuel feedstocks", degree expected December 2017
- Whitney Ray, NREM M.S. Plan A, Thesis option, "Greenhouse gas emission balance of biofuel feedstock for potential carbon trading", degree awarded December 2014.
- Meghan Pawlowski. "Greenhouse gas flux and fine root dynamics of sugarcane and Napier grass under deficit irrigation", degree awarded May 2013.
- Yudai Sumiyoshi, M.S. Plan A, Thesis option, "Belowground carbon cycle of Napier and Guinea grasses grown for sustainable biofuel feedstock production", degree awarded December 2012.
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- **Extended Abstract:**
- Hashimoto, A., J. Arnold, J. Ayars, S. Crow, T. Eggeman, L. Jakeway, M. Karkee, S. Khanal, J. Kiniry, J. Matsunaga, N. Meki, G. Murthy, M. Nakahata, R. Ogoshi, B. Turano, S. Turn, J. Yanagida, Q. Zhang. 2012. High-Yield Tropical Biomass for Advanced Biofuels. Sun Grant National Conference, New Orleans, LA, October 3-5, 2012.
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- **Manuscripts**:
- Youkhana, A.H., S.E. Crow, R. M. Ogoshi, J.R. Kiniry, M.N. Meki, and M.H. Nakahata. Allometric models for predicting aboveground biomass, C and N stocks of biofuel crops in Hawaii. *In review at Crop Science.*
- Sumiyoshi, Y.*†, S. E. Crow†, A. Taylor, C.M. Litton, J.L. Deenik, B. Turano, and R. Ogoshi. Belowground impact of napier and Guinea grasses grown for biofuel feedstock production. *In preparation for Global Change Biology Bioenergy*. † Shared first authorship.
- Crow, S. E., L. Deem*, Y. Sumiyoshi*, H. Yamazaki*, N. Hunter**, J. Wells*, J. Deenik, R. Ogoshi, B. Turano. Soil carbon dynamics following conversion to tropical perennial grass feedstocks for biofuel from fallow. *In preparation for Agriculture, Ecosystems, and the Environment.*
- Crow, S. E., and C. A. Sierra. Dynamic intermediate soil carbon cycling pools may drive future responsiveness to environmental change. *In preparation for Global Change Biology*
- Pawlowski, M.*, S.E. Crow, M.N. Meki, J. Kiniry, A. Taylor, and R. Ogoshi. Soil and water conservation practice effects on global warming potential, root and soil carbon stocks and dynamics in sugarcane and Napier grass grown for bioenergy production. *In preparation for Agronomy Journal*.
- Youkhana, A., S. E. Crow, R. M. Ogoshi, J. R. Kiniry, M.N. Meki, and M. Nakahata. Above and belowground biomass and carbon dynamics under ratoon and plant crop practices for biofuel feedstock production in Hawaii. . *In preparation for Biomass and Bioenergy.*
- Meki, M. N., R. M. Ogoshi, J. R. Kiniry, S. E. Crow, A. H. Youkhana, M. Nakahata, and K. Littlejohn. A comparative performance evaluation of biomass sorghum in Hawaii and Texas. *In review at Crop Science*
- Wells, J. M.*, S. E. Crow, R. Ogoshi, B. Turano, A. Hashimoto. 2015. Optimizing feedstock selection for biofuel production in Hawaii: CuO oxidative lignin products in C4 grasses. Biomass and Bioenergy: in press.http://dx.doi.org/10.1016/j.biombioe.2015.10.027.
- Meki, M. N., J. R. Kiniry, A. H. Youkhana, S. E. Crow, R. M. Ogoshi, M. Nakahata, R. Tirado-Corbala, R. G. Anderson, J. Osorio, and J. Jeong. 2015. Key crop growth parameters for modeling two-year cycle sugarcane. Journal of Agronomy 107: 1310-1320.
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- **Book Chapter:**
- Meki, M. N., J. R. Kiniry, K. D. Behrman, M. N. Pawlowski*, and S. E. Crow. 2014. The role of simulation models in monitoring soil organic carbon storage and greenhouse gas mitigation potential in bioenergy cropping systems. Book Article in $CO_2$ Sequestration and Valorization, Ed. V. Esteves, InTech.

- **Conference presentations:**

- Crow, S. E., M. N. Meki, J. Kiniry, R. Ogoshi, A. Youkhana, M. Pawlowski*, M. Nakahata. Projecting global warming potential of productions systems for tropical perennial C4 grasses cultivated for biofuel feedstock in Hawaii. ASA, CSSA, and SSSA International Annual Meetings, Minneapolis, MN, November 2015. (contributed poster)

- Richardson, D*. S. E. Crow, A. Youkhana, J. Moore-Kucera, R. Ogoshi, M. N. Meki, J. R. Kiniry, M. Nakahata. Root biomass and microbial response to deficit irrigation treatments in the rhizosphere of biofuel feedstock cultivation in Hawaii. ASA, CSSA, and SSSA International Annual Meetings, Minneapolis, MN, November 2015. (contributed poster)

- Wells, J.*, S. E. Crow, A. Hashimoto, R. Ogoshi, J. R. Kiniry. Transforming conventional sugarcane into sustainable biofuel feedstock production: Optimizing C4 grass feedstock selection through lignin analysis and conversion efficiency study. American Society of Agricultural and Biological Engineers 2015, 1st Climate Change Symposium, Chicago, IL, May 2015.

- Youkhana, A., S. E. Crow, J. Kiniry, M. N. Meki, R. Ogoshi, and M. Nakahata. Above and belowground biomass and C dynamics under ratoon harvest practices for biofuel feedstock production in Hawaii. ASA, CSSA, and SSSA International Annual Meetings, Long Beach, CA, November 2014. (contributed poster, abstract accepted)

- Hashimoto, A., R. Ogoshi, D. Takara, S. Khanal, and S. E. Crow. High-yield tropical biomass feedstocks for bioenergy production. 22nd European Biomass Conference and Exhibition, Hamburg Germany, June 2014. (contributed poster, abstract accepted)

- Meki, M. N., J. R. Kiniry, A. Youkhana, M. Nakahata, R. Ogoshi, and S. E. Crow. Key crop parameters for ALMANAC modeling of high biomass energy sorghum growth and productivity. ASA, CSSA, and SSSA International Annual Meetings, Tampa, FL, November 2013. (contributed poster)

- Youkhana, A., S. E. Crow, M. N. Meki, J. R. Kiniry, R. Ogoshi, and M. Nakahata. Belowground biomass and C dynamics in sugarcane and ratooning energycane cultivated as biofuel production in Hawaii. ASA, CSSA, and SSSA International Annual Meetings, Tampa, FL, November 2013. (contributed poster)

- Meki, M. N, J. Kiniry, A. Youkhana, M. H. Nakahata, S. E. Crow, R. Ogoshi, J. Steiner. Parameterization of the ALMANAC model to evaluate novel high biomass crops on Maui, Hawaii. ASA, CSSA, and SSSA International Annual Meetings, Cincinnati, OH, October 2012.

- Pawlowski, M.*, S. E. Crow, J. L. Deenik, C. Evensen. Linking soil and water conservation practices to greenhouse gas flux and fine root dynamics: A comparison of sugarcane and Napier grass grown for bioenergy production. ASA, CSSA, and SSSA International Annual Meetings, Cincinnati, OH, October 2012.

- Pawlowski, M.*, S. E. Crow, Y. Sumiyoshi*, J. Wells, and H. Kikkawa**. Greenhouse gas flux under warm-season perennial $C_4$ grasses across different soil and climate gradients on the Islands of Hawaii. American Geophysical Union Annual Meeting, San Francisco, CA, December 2011. (Contributed abstract)

- Hashimoto, A., S. Chiang, S. E. Crow, S. Khanal, C. Kinoshita, R. Ogoshi, W. Su, G. Tsuji, B. Turano, G. Uehara, and J. Yanigita. Development of high-yield tropical feedstocks and biomass conversion technologies. World Congress on Zero Emissions Initiatives, Honolulu, HI, September 2010.