

## Considering pests, weeds and diseases and other constraints and management to improve modeling

- Why is this action item important/why should it be addressed?
  - Pests, especially weeds, disease and insects are a significant harm in crop production. Yet their response to CO<sub>2</sub>/C.C. either sole or in integration with crops is poorly understood. A better understanding is required to improve global food security.
  - There is not enough information available on modeling on disease and weeds.
  - Diseases and weeds are a major threat to some areas for a major part of yield loss.
  - Lots of unknowns around these species
  - Gap in current crop models that might alter conclusions/implications
  - Interactions and stability in yield
  - Population size increasing from 7 to 9 billion in 2050 relative 2010 and 10% malnourished expected,
  - Food production needs to be increased 70 to 100%
  - Pest (15%), diseases (13%), and weeds 13% cause 42% global annual yield loss
  - Climate change increase pest induced yield loss
  - We need to address this component by coupling with crop models
  - Modeling crops has often excluded biotic stressors and management decisions – these are needed to understand effects of climate, especially variety and extremes.
  - Without biotic constraints, models will not be as useful
  - Very little synthesis or understanding in the literature or how insects/weeds/pathogens will be distributed in future climate change scenarios.
  - Lots of anecdotes of new diseases and pests, not much data and evidence
  - Currently a big gap in most assessments
- What needs to be addressed within this action item?
  - Develop models that are on a finer scale and could be utilized on a farm field scale for decision making
  - Develop system thinking and model skills (system dynamics)
  - Need to put processes into models and then test with field data
  - Combining data
  - Databases with API's which standard means of allow transfer/querying
  - Develop better models that are on a finer scale, well validated under different
  - Development of relationship between different parameters and (crop, weather and others) with disease/pest/weeds infestations
  - Pick one pathogen system that is "low harming fruit" like rusts
  - Will help to determine the effects of climate change on multiple factors (e.g. soil) to allow for development of effective and sustainable management practices
  - We need a better systemic understanding to make informed decisions at all levels of farm to government
  - Agriculture stems is too complicated by invertebrate fauna. There are many interaction between the element of ecosystems and there is many interaction between the,, host plants, pathogens
  - We should make a model to protect the beneficial, control pest and disease as much as possible
- Disease Model Development and data
  - Find/develop systems skills
  - Ag MIP – wheat trust team

- Resources – Hollywood movie
- Take stock (data – public/private), process, activities
- Farmers/policy makers
- Understand weeds of crops and diseases
- Generic model
- Use existing data, new experiments
- Natural enemies
- Consider more logistic approaches, cropping systems
- Infrastructure/Standards
  - What steps
    - Community engagement – get the people/groups that exist involved
    - Identify infrastructure needs and development plan for phased development
  - When
    - Goals: at differing scales, develop timelines and budgets for ongoing development of I and S.
  - Communication:
    - Technical people, funders, end-users, data generators, infrastructure developers, administrators/organizers
  - Success:
    - Distributed system
    - Federated
    - Harmonized
    - Central metadata search/store
    - Defined subset of standards
    - Easy to join and contribute
  - Opposition:
    - Culture against sharing
    - Time requirements
    - Money requirements
    - Lack of recognition
  - How to get around?
    - Incentives – citation
    - Help for users/partners
    - Templates
    - Tutorials
  - Funding
    - Develop use-case driven vision that speaks to needs of various public and private sector entities – this should be backed by robust needs assessment
    - Very bare proof of concept – if possible
    - Identify key champions and potential donors
    - Identify key partners based on needs and capacities – and articulate their roles
    - Develop/formalize a consortium and workable governance model
    - Institutionalize/identify host (e.g. a land grant university?) possible with USDA assistance
    - Articulate realistic and innovative sustainability/business model
    - Clearly identify paths/approaches to dovetail/collaborate with other existing or emerging efforts