



Valuing pollinator habitat: more challenges than solutions?



Presented at the *Quantifying Ecosystem Services and Co-benefits of Nutrient and Sediment Reducing BMPs* workshop.

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Background

Why care?

- Estimates of the annual value of pollinators in the United States range from \$150 **million** to \$19 **billion**
- Honeybees provide ~ \$350 million in pollination services annually (for example, almonds)
- \$330 million in honey production annually
- Some crops (such as watermelons and blueberries) greatly benefit from native pollinators that rely on quality habitat



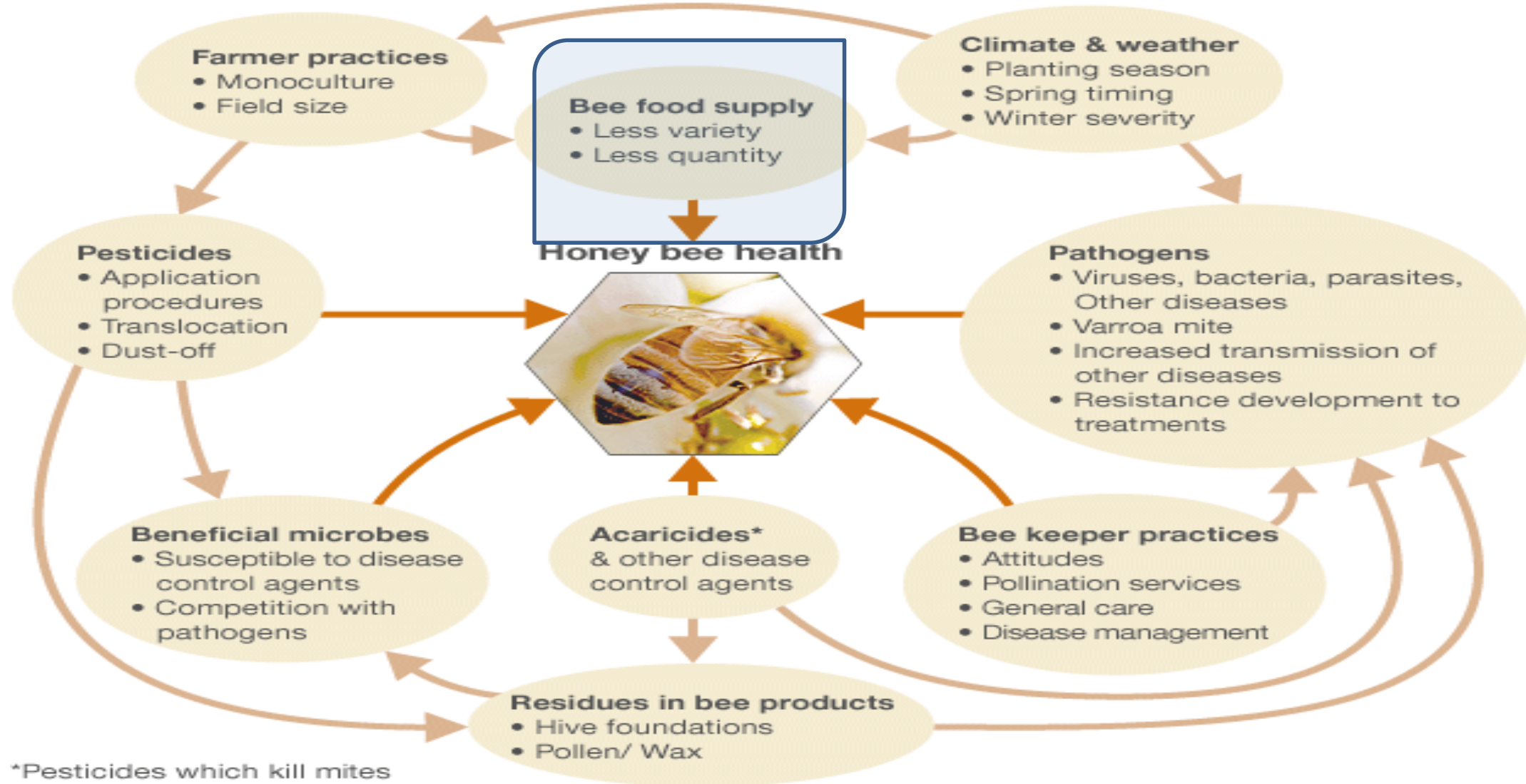
Pollinator issues: annual honeybee colony losses are increasing



Source: Bee Informed Partnership, and NASS Honey Report



Stress factors in honey bee populations



*Pesticides which kill mites

Source: OPERA Bee health in Europe, 2013



Importance of land use ... forage!

Honeybee colonies in landscapes with good forage means

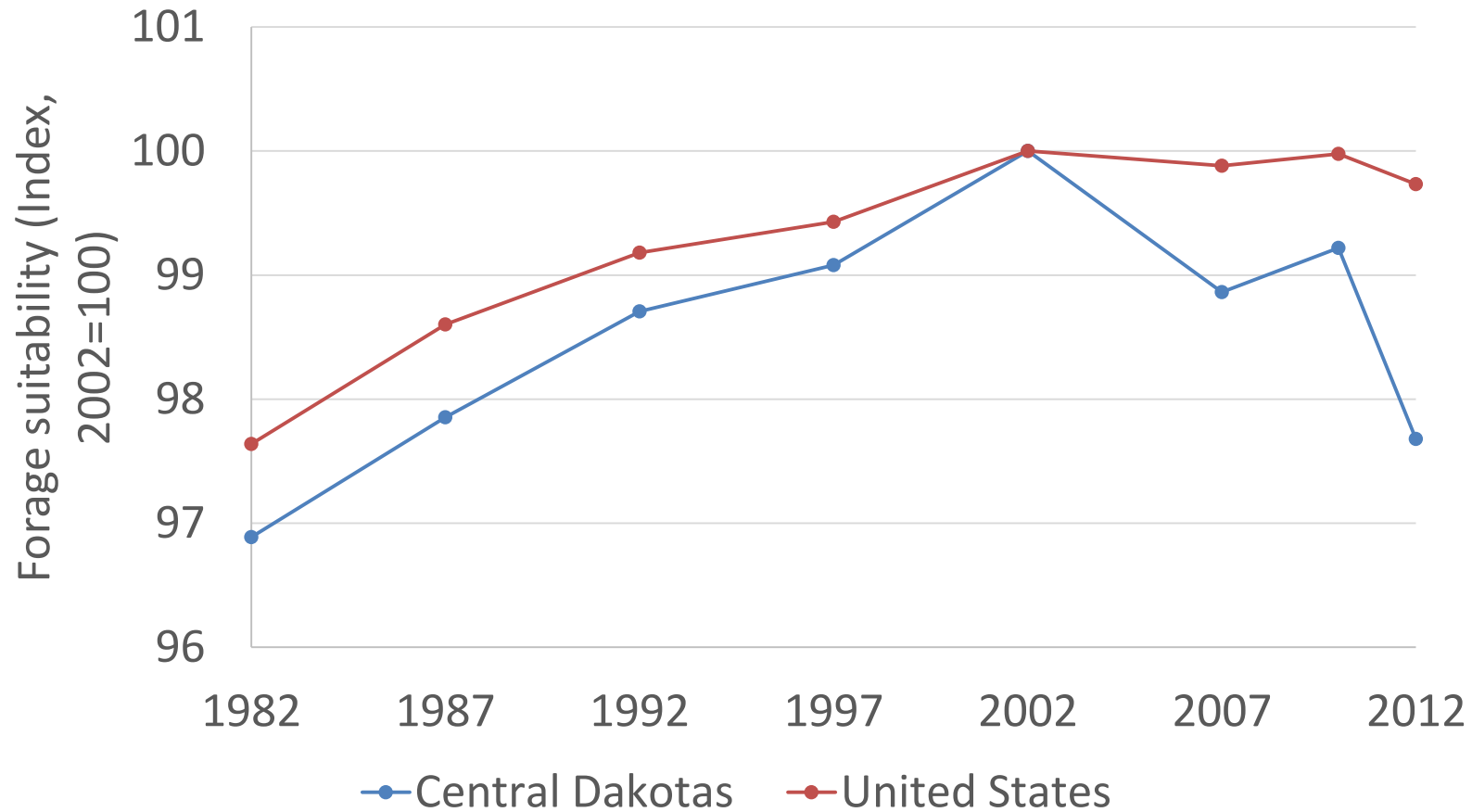
- More nectar
- More and better pollen (bees need 10 amino acids!)
- More “brood”

& “healthier” colonies are better able to survive stresses (mites, insecticides,...)

For native pollinators, a similar story can be told (though one focusing on both forage and nesting qualities)



Trends in Bee Forage Suitability of Land: United States and the Central Dakotas.



Source: ERS analysis using Natural Resource Inventory data



Valuation

Consider this issue: *what are the benefits to pollinators from installing BMPs*

Calculating the social value of this beneficial forage requires multiple steps:

- What is the impact on the landscape
- What is the impact on pollinators
- How does this impact translate into changes to goods and services people care about
- What is the value of these *goods and services*



Examples of *Goods & Services*

Commercial pollination by honeybees	Change in likelihood that hive will be weak/strong at point of service (monetized)
Honey production	Change in honey output (monetized)
Pollination by native pollinators	Yield increases on neighboring cropland (monetized)
Biological control of pests	Cost savings from reduced pesticide use (monetized)
Recreation (birding)	Change in the quantity of birding
Aesthetic value	Change in floral species richness, weighted by human populations Appreciation for more diverse bug population?



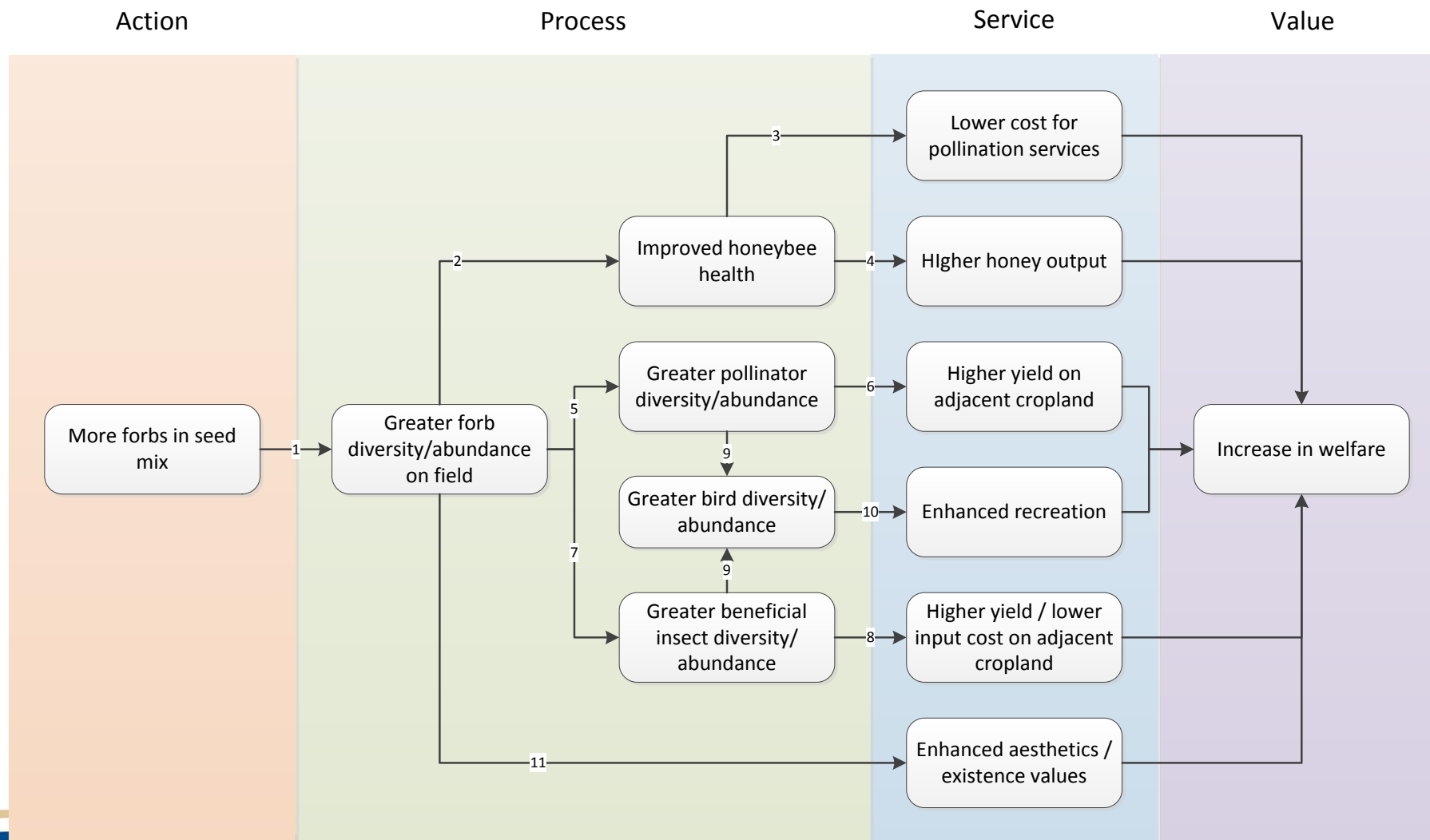
None of the *goods and services* have values that one can pull off the shelf

A recent CFARE working group considered this issue, focusing on the values of tweaking CRP parcels (installing pollinator habitat instead of simple grass mixes)

http://www.cfare.org/UserFiles/file/Chapter1-AssessingPollinatorHabitatServicesToOptimizeConservationPrograms_v2.pdf



The case study considered ... a pollinator habitat causal chain



Steps in measuring the *pollination services provided by honeybees*

<i>Forage improvement (more forbs)</i>	What is the “per parcel” benefit - extra pollen, nectar, etc ?
<i>Honeybee direct effects</i>	Will honeybees utilize? Are there honeybees nearby who will “forage” on an improved parcel ?
<i>Honeybee mid-term effects</i>	How does forage translate into more brood, or longer lifespan, or greater activity, of bees in the colony?
<i>Colony impacts</i>	Will the colony be “stronger”? Can better forage help a colony withstand the various stressors?
<i>Survival</i>	How more likely will a stronger colony survive the winter?
<i>More colonies</i>	Beekeepers have more colonies to offer to farmers (they can avoid the expense of creating new colonies)
<i>Lower costs to farmers</i>	More ag profit, more production (lower consumer prices)



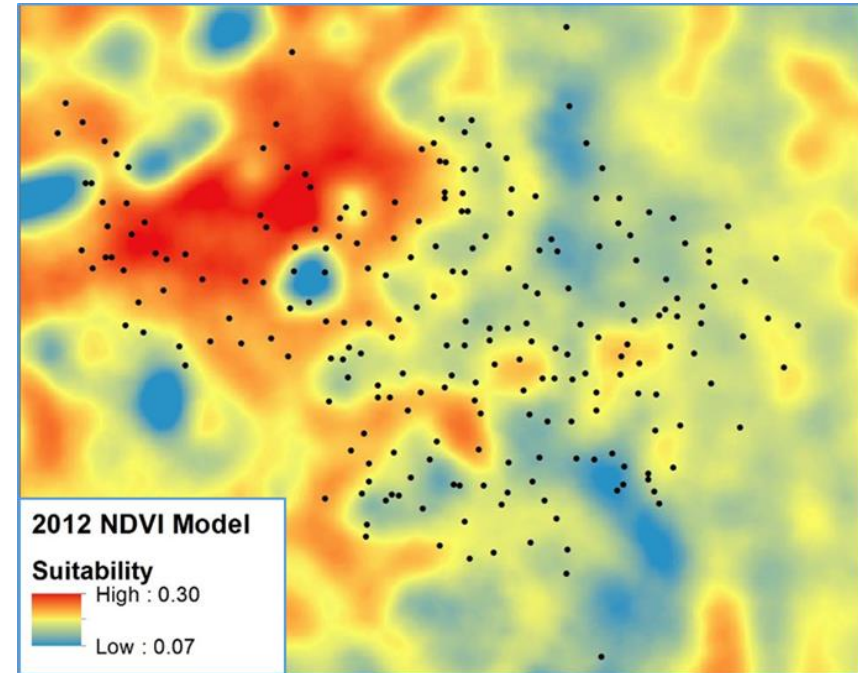
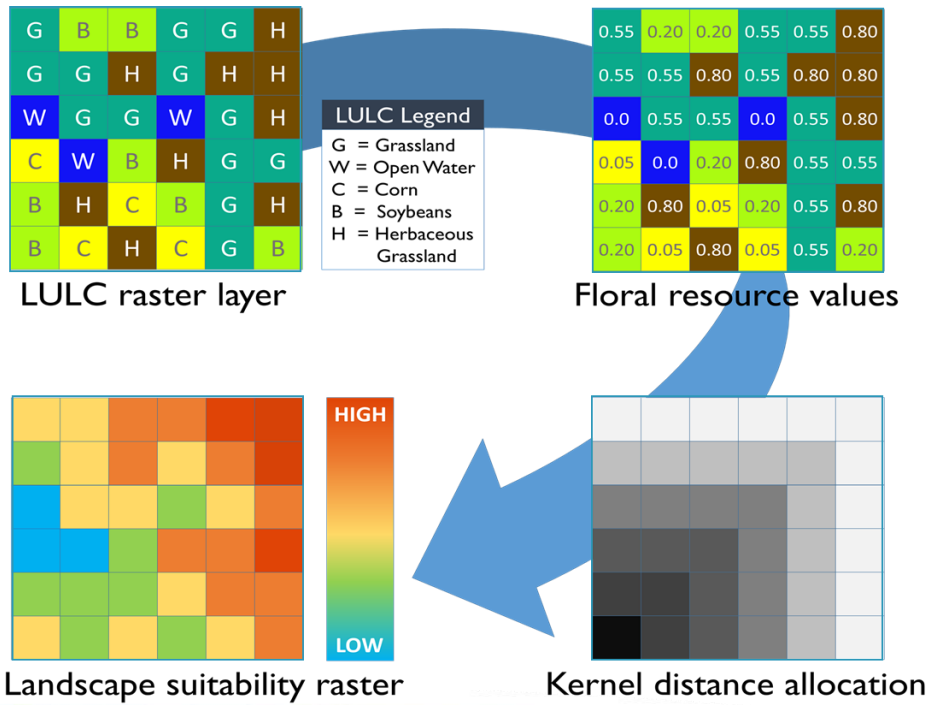
Example: how would improved forage affect honeybees & pollination services?

Forage improvement (say, via forb rich seed mix)

Honeybee direct effects

Honeybee mid-term effects

GIS-like models (**ABEILLE**, aka INVEST) can approximate colony strength as a function of the landscape. Since bees move around, and colonies are moved around, any one site change will effect a number of colonies a little bit!



Colony impacts

Not much that directly links measures of hive strength to long term survival

Survival

Need to track colonies over time –

- Forage near their colonies over the year
 - Did the colony survive?
 - How strong (number of bees, health of queen)?

More colonies

No simple model that relates hive strength & colony numbers to economic returns.

Lower costs to farmers

Need models of demand and supply:

- Reduced costs to beekeepers of stronger colonies
- Increases supply (lower cost and/or greater effectiveness) to farmers

How to measure “robustness” (the reduction in the chances of big disruptions)?



Benefit Relevant Indicator

Complementary Inputs

Not relevant



Pollinator Habitat



Food Provision

BRI: Area of pollinator-dependent crops within flying distance of pollinator habitat



Relevant if within range





United States Department of Agriculture

Take aways

- Conceptually, it isn't that difficult to measure the “social value” from healthier pollinator populations due to land use changes
- But the devil is in the myriad details – such as the value of an x% increase in overwinter survival of N colonies
- We have some models that get us part way there, but they are all best thought of as exploratory
- Benefit relevant indicators can proxy for changes, providing a means of comparing the “effectiveness” of different policies

