NSF-GRFP RESEARCH STATEMENT OUTLINE

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Project Background:

- greater *Zea* phylogeny can be improved based on understanding of admixture with maize
- *Zea luxurians* phylogeny can be improved based on understanding of admixture with maize *So how exactly will an understanding of admixture improve the phylogeny? What's missing in our current understanding of the relationship between these taxa?*
- we are interested in admixture, explain how hybridization can lead to haplotype transfer between species and subspecies
- maize is a good study system because it's agriculturally important and has great variety over a wide area *both subspecies and species of* Zea *demonstrate local adaptation and may have conferred these adaptations to maize during its spread across the Americas. Conversely, non-domesticated species in* Zea *may have been altered through gene flow from maize.*
- maize hybrid zones exist
- we have found interesting hybrid populations near proposed areas of maize domestication
- we have many questions about these populations *I would consider focusing on either dynamics across the entire* Zea *genus or on the* parviglumis/mexicana *hybrid zones, with a preference toward the latter since this is the work we have proposed to take place here at ISU in the NSF-DEB grant. Also, it would probably be a good idea to take some area of that proposal and extend it further to show how you plan to take ownership and expand on the goals of the project as part of your Ph.D.*
- explain our dataset *or rather, explain the data that are available to us and the data that we would need to generate*

Project description: *Here I would be sure to break your project plan down into clear aims/objectives that very cohesively form the overall project. It would be ideal if the aims would flow into each other, but that's not essential*

All Zea: Goal: Determine the extent and nature of the affect of the post-domestication spread of maize on both wild and domesticated allopatric Zea populations.

Q1a: Did the spread of maize facilitate gene flow between wild allopatric Zea populations?

Q1b: Was the successful spread of maize bolstered by introgression from wild locally adapted zea populations?

Methods: Zea Phylogeny: Treemix/Spacemix (greater phylogeny) (looking at landraces) (resolving *luxurians*)

Methods: Gene Flow: Treemix/Spacemix, STRUCTURE, Fst, heterozygosity

Hybrid populations: Goal: Determine the taxonomy, demography and degree of local adaptation of parv/mex hybrid populations in central and southern Mexico

Q2a: Where are these populations distributed across Central and Southern Mexico?

methods: find them: GBS *I think this goal can be accomplished with the already-published SNP-chip data. I would argue that you find admixed populations with the SNP-chip data then focus in on admixture across genomes using GBS data*

methods: identify them: STRUCTURE *maybe mention Reich's F-statistics as well...will impress reviewers and is a nice confirmation of the trends seen in STRUCTURE*

Q2b: Are these populations stable, locally adapted populations or simply a product of ongoing hybridization between neighboring Zea populations?

methods: relative fitness: common garden experiment

methods: origin: MSMC *I'm not clear on how MSMC would be used for this particular question*

Q2c: What is the relationship of these hybrid populations with each other and their neighboring Zea populations?

methods: diversity: heterozygosity, Fst *so heterozygosity gets at diversity, but Fst gets at differentiation...two different descriptions of populations*

methods: taxonomy: Dstatistic, Treemix/Spacemen

methods: gene flow: STRUCTURE, Treemix/Spacemix *I'm not clear on how taxonomy and gene flow are distinguished here*

Resources needed: **People:** me, Matt Hufford, Jeff Ross-Ibara, Mexico collaborators

money: my salary, common garden materials (low cost is a selling point)

Project impacts: *So we'll need a "Broader Impacts" section that is less about the impact of the project on **science** and more about the impact of the project on **society***

Maize Community: better greater phylogeny, better landrace phylogeny, resolved luxurians

Evolutionary Biologists: more info about the nature of hybridization and it's affect on evolution

me: I'll gain skills necessary to go on and tackle other problems

gk12:

collaboration w Mexican academics:

Works Cited: