* ***Introdução***
  + climate change changin biodiversity
  + lack of knowlegde about these changes on functional diversity
  + motivo para estudar

Climate change, as reduced precipitation, is already changing biodiversity all over the world by eliminating species or changing the communities composition (REFERENCIA). However, much less is known about the effects on functional composition (i.e. the diversity and abundance of traits) (ENQUIST; ENQUIST, 2011; ESQUIVEL-MUELBERT et al., 2018; SAKSCHEWSKI et al., 2016)⁠⁠ and, especially, on functional diversity in terms of its different components (richness, evennes and divergence) and mainly regarding to the multidimensional aspect of functional diversity. This gap of knowledge is particularly relevant in hyperdiverse ecosystem such as Amazon and that also have been threated by more frequent and more severe droughts.

* ***Reduced precipitation and the effects on functional composition***
  + nossos resultados mostraram mudança na composição funcional (diversidade e abundância dos atributos
  + em acordo com previsões anteriores: derivado de reorganização na comunidade por extinçaõ de spp ou mudança na dominancia

Our results show that the applied scenario of reduction on precipitation clearly changed the functional composition of Amazon forest, both in terms of the diversity and abundace of traits (Figure, Table XXXX). These results are in agreement with previous theoretical, observational and experimental studies that argue that a change in moisture stress, and environmental change as whole, is able to drive functional composition shifts (AGUIRRE-GUTIÉRREZ et al., 2019; ENQUIST; ENQUIST, 2011; ESQUIVEL-MUELBERT et al., 2018; NEPSTAD et al., 2007; PHILLIPS et al., 2010; SAKSCHEWSKI et al., 2016)⁠. This functional composition shift is derived from a reorganization of the community due to, for example, species extinction or by just a reorganization on community dominance (ENQUIST; ENQUIST, 2011; GONZALEZ; LOREAU, 2009)⁠. The indices resulted from our analysis that compare, before and after the disturbance, the dissimilarity between the curves (in the case of the single-trait analysis; Table XXXX) and the similarity between the hypervolumes (in the case of multi-trait analysis; Jaccard index equal to 0.036) show that the scenario of reduced precipitation has led to a significant functional reorganization of Amazon forest.

* ***Modificação devido à mudança no filtro ambiental***
  + resultado devido à mudança no filtro
  + quais estratégias foram selecionadas?
  + Consequencias:
    - 1) mudança no sentido de estratégias mais tolerantes à seca. Resultado observado em outros estudos
    - Por conta do trade-off tem menos tecido lenhoso, tecidos lenhosos são os que mais contribuem para a biomassa total, o que pode ter enviesado o resultado no sentido de alta perda de biomassa. Quais as consequencias disso para o carbon storage total?

All the observed changes on functional composition was due to the alteration on the environmental filtering, in other words, the drier condition selected strategies that coped better with the moisture stress. This selection was in the direction of strategies with higher values towards fine roots allocation and residence time to the detriment of allocation in other compartments, specially on woody tissues (these results can be seen in the PCA (Fig XXX) and in the trends of the values distribution (Fig XXX and Table XXXX)). This observed change on functional composition had two consequences: first, because in our model higher values of fine roots biomass (determined by carbon allocation and residence time) is linked to higher capacity of water uptake, we can infer that the imposed drought led to a change in functional composition towards more dry-affiliated strategies. The same type of shift in functional composition was observed in Amazon (ESQUIVEL-MUELBERT et al., 2018; MADANI et al., 2018; PHILLIPS et al., 2010)⁠ and other tropical forests(ENQUIST; ENQUIST, 2011; FAUSET et al., 2012; FEELEY et al., 2011)⁠. The post-disturbance functional composition observed in our study avoided the complete loss of biomass in some areas (Figure XXX), mainly the ones that are naturally drier (see section XXX).

Second, the observed increase in fine roots biomass was at the expense of investiment in woody tissues. This is a product of the trade offs *a priori* defined (for example, the allocation to one compartments always restrics the allocation to another; Table XXX) and of the trade-offs that emerge from the model itself. The most proeminent emergent trade-off was the one observed between fine roots and aboveground woody tissues traits (Figure PCA XXX). The trade-off between root and aboveground woody tissues was also found in observational studies in Amazon (MALHI; DOUGHTY; GALBRAITH, 2011)⁠ and other forests around the world (WOLF; FIELD; BERRY, 2011)⁠. Despite the advantages conferred by the increase in fine roots biomass against the drier climate, it can result in relative lower values of total plant biomass and, consequently, to a smaller capacity of ecosystem to store carbon. This is because fine roots are plant tissues of short duration and contribute much less to the total plant biomass when compared to aboveground woody tissues. Because of this, the functional composition shift may have biased our results concerned to the imapcts of reduced precipitation on the Amazon ability to store carbon (see section XXX). In that sense, future studies using CAETÊ to understand the impacts of climate change, should use traits and trade-offs that are more mechanistically related to the role of woody tissues in determine the ecosystem resistance to disturbance (e.g. woody density, cavitation vulnerability and adult plant height; PHILLIPS et al., 2010; ROWLAND et al., 2015⁠) .

* ***Modificação na dominancia e o papel da dinamica compensatórtia***

The modification on environmental filtering as we applied by reducing precipitation also affects the abundance of strategies and, consequently, the frequency distribution of trait values, what, ultimately, change the dominance relationship between strategies (ENQUIST; ENQUIST, 2011; ESQUIVEL-MUELBERT et al., 2018)⁠. Amazon forest is widely known for its high diversity of species, however the abundance distribution of trees is also highly skewed, in other words, an hyperdominance is observed in this ecosystem (FAUSET et al., 2015; TER STEEGE et al., 2013)⁠. In fgure XXX is possible to see, through the high curves skeweness and positive kurtosis (ENQUIST et al., 2017)⁠, that in the regular climate condition the analysed community display a hyperdominance around a small range of trait values. However when the precipitation is reduced the distribution in the values frequencies is modified towards a reduction in the hyperdominance: lower skweness and more negative kurtosis in the single-trait curves (Figure XXX) besides a spread in the occupance of the functional space in the hypervolume (Figure XXX). This is in agreement with the theory that a change in climate can cause a change in domincance thourgh a compensatory dynamic in communities: when the composition of an ecosystem adjust to the new conditions enabling types of plants that previsouly exerted a lesser functional role turn into a functional dominant strategy and vice-versa (GONZALEZ; LOREAU, 2009; SAKSCHEWSKI et al., 2016)⁠. In that sense, we observed that the compensatory dynamic in Amazon forest with the decrease in dominance allowed the emergence of new strategies and/or trait values that dealt better with the new climatic condition. This compensatory dynamics with shift in functional composition and in dominance was found in another modelling study for Amazon basin (SAKSCHEWSKI et al., 2016)⁠ and also in observational or experimental studies in tropical forests (ENQUIST et al., 2017; ENQUIST; ENQUIST, 2011; ESQUIVEL-MUELBERT et al., 2018).⁠ It means that the dominance today observed in Amazon could shift in the future (SAKSCHEWSKI et al., 2016)⁠ .

The compensatory dynamics impediu a perda total de biomassa para certas regiões, entretanto outras questões podem ser comprometidas. (pensar a longo prazo, por exemplo)

Theoretically, the compensatory dynamics would confer more resilience against environmental change (REFERENCIA). Entretanto se este tipo de dinamica pode, de fato, aumentar a resiliencia dos ecosistemas is still an open question, since the new functional composition may lead to different ecosystem functioning and look only into biomass may be not the best way because other ecosystem processes may be comprised.

* ***Modificação nas variáveis de diversidade funcional e o significado ecológico***
  + - * + Algum estudo procurou entender isso?

Together, the change in functional composition and in dominance provoked a change in all the components of functional diversity (Table/Figure XXX). Several studies claim for a decrease in taxonomic diversity, such as richness, with climate change like reduced precipitation (REFERENCIA), However the knowlegde of the impacts on functional diversity is largely negligenciado, desconhacido e etc (PETCHEY; GASTON, 2002)⁠. The studies concerned to understand the impacts of climate change on functional diversity mainly focused on functional composition (REFERENCIA), however functional diversity has different facets that express different ecological meaning. To date, this is the first modelling study to address the modification in all the functional diversity facets for Amazon forest. We found both for single-trait and multi-trait an unexpected and significant increase in functional richness. Daí se dá a importância de analisar a diversidadde funcional. O aumento da riqueza foi principalmente determinado pela diminuição da dominancia o que permitiu o surgimento de novas estrartégias de modo que o espaço funcional fosse melhor ocupado.

The emergence of new traits and changes in value frequencies led to impacts on functional diversity variables. It is especially notable the increase in functional diversity. discutir as implicações ecológicas nas mudanças de cada variável de diversidade funcional (ver isso em (MASON et al., 2005)⁠)

The increase in functional diversity (i.e. increase in the occupance of the range of values) leaded to an increase in the volume occupied by the strategies. Suportado por: Sufficiently large changes in environmental conditions are expected to produce shifts in community structure and composition that will cause the hypervolume to shift.

* 1. quais as implicações da mudanças na diversidade funcional tanto para single traits como para multitraits para resistência/resiliência da floresta amazônica.
  2. A área que pegamos para analisar é muito grande?
  3. uma comunidade mais diversa funcionalmente apresenta também maior diversidade de respostas, que futuramente podem levar a maior resistência a novos distúrbios
* ***Discuta as implicações para o conhecimento ecológico desse tipo de análise*** 
  + como esse tipo de modelo ajuda a entender isso (papel da dinâmica compensatória na resiliência/resistência dos ecossistemas)
* ***Fechamento (o que mais poderia ser feito)***
  + área analisada é muito grande?
  + Utilizar traits diretamente hidráulicos?