Project Update: May 2019
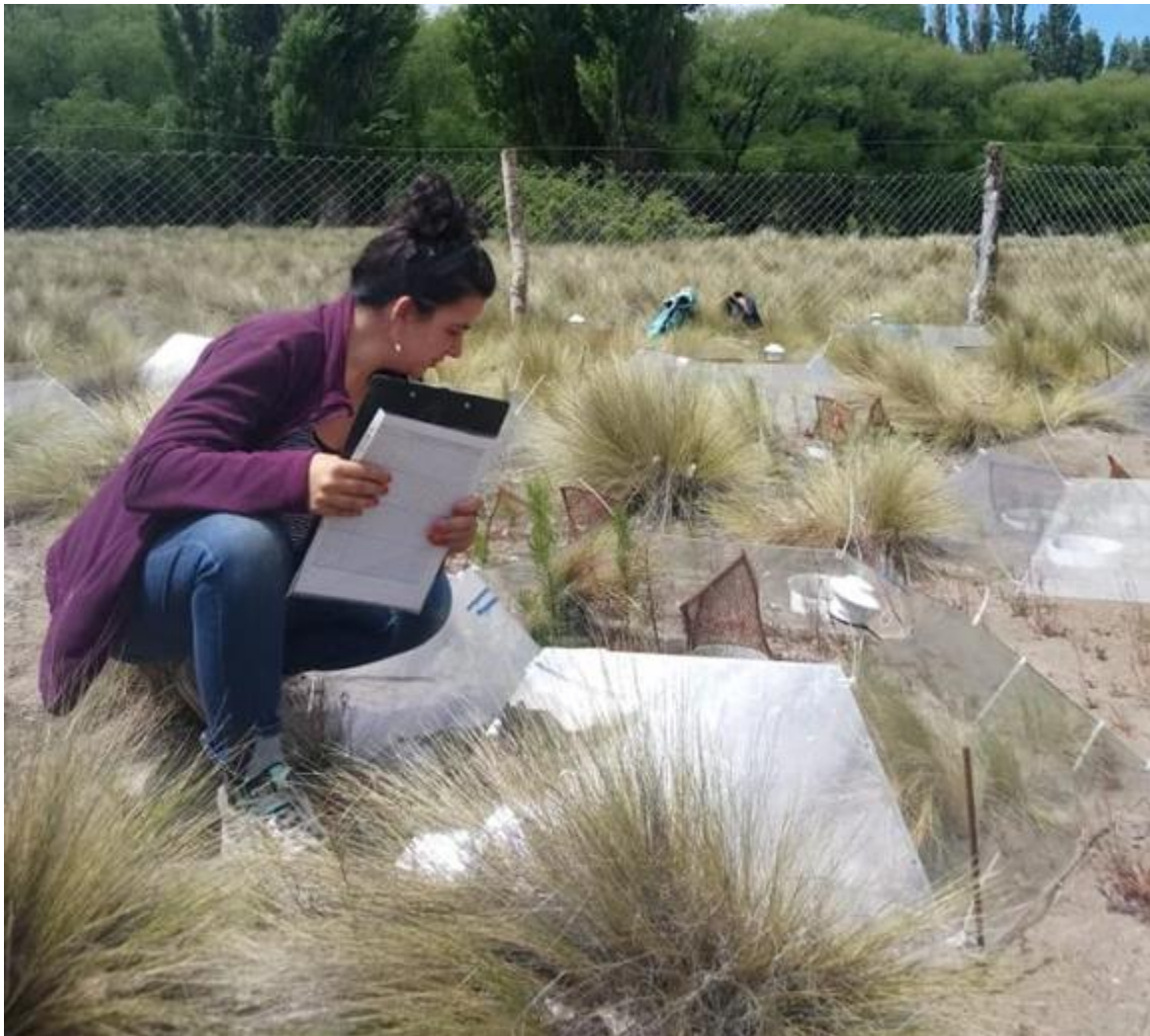
Since September 2018 we have carried out this study in the region, particularly in Rio Negro and Neuquén Provinces. We have made significant progress in our objectives and work with different stakeholders, and land owners, also we get support from forest managements and national park administration.

We have made progress in:

Experimental work. ©Ramiro Ripa

We carried out the full experiment, established the field experiment and evaluated seedling and sapling responses to temperature and precipitation. We started at the end of September 2018 and until March 2019 we applied water treatment and registered emergence and death of seedlings and saplings. We have 20 open top chambers and have 10 replicates for each treatment. We have in each replicate five samples for each species (*Pinus ponderosa* and *Pinus contorta*) and 15 seeds for each species. We reduced the number of replicates and the number of seedlings because economic and space issues.

So far we have obtained interesting results regarding the emergence and survival of the seedlings. Both species *P. ponderosa* and *P. contorta*, emerged in all

treatments but we found more emergence in treatments with increase in temperature for Ponderosa pine. Related to survival, we found until mid-March 2019, low survival in *P. contorta* - this species only survived individual in treatment with increase in precipitation. For *P. ponderosa* we found more survival in controls and also in the precipitation treatment. Related to sapling survival, we found more survival in *P. ponderosa* than *P. contorta* in all treatments. These preliminary results could be indicating a high resistance of *P. ponderosa* to an increase in temperature, which could be suggesting a high potential invasion in the context of climate change in the region.

Currently, we are processing the aerial and root biomass of the saplings. In turn, the percentage of mycorrhiza colonization and the biomass of the seedlings. We expect to find differences in these variables according to the treatment applied.

Field work. ©Aimé Iglesias

To determine the relation between climatic variability and successful pine establishment across heterogeneous landscapes, we carried out the fieldwork in 10 sites. We work in invaded areas next to *Pinus contorta* and *Pinus ponderosa* plantations. We extract 90 individuals per site at three different distances from the border to the plantation. We decided to reduce the total number of sites to survey and increase the number of samples to collect because it was not easy to get the permission of the owners to perform this work of removal of pines. We will have to extend the period of collection of these data because currently the climate makes it difficult to carry out this work in the field. So far we have started with sample preparation, drying and sanding, but we have not started with reading ages and wide of rings.

New field work. © Aimé Iglesias

We have considered adding a new part to the project. The removal of invasive individuals and the subsequent recolonisation or restoration of native vegetation are the main objectives in the management of areas invaded by exotic conifers. The management of the invasion of exotic conifers, mainly species of the genus *Pinus*, is a challenge little explored in the Patagonian region. According to this we evaluate the re-invasion of P*inus contorta* in post-removal areas with different degrees of previous invasion. During 2014-2015, 12 sites invaded by *P. contorta* were selected and all individuals were removed in 20 x 20m plots with different degrees of invasion (575 to 14500 ind/ha). After 5 years (2018-2019), the total density of re-invasion, age, reproductive stage, total biomass and presence and identity of nurse species we studied. We predicted that the previous density would determine the current density, as well as the coverage of shrub species or perennial herbaceous plants would favor the establishment. So far we have not

found any variable that explains the heterogeneity of reinvasion found in the sites. Neither the density of previous invasion, nor the cover of perennial shrubs or herbaceous plants explained the current density of reinvasion. But we found a positive relationship between established individuals and the presence of native nurse species. In addition, we have compared the previous basal area and the cost of handling the invasion, with the current basal area of reinvasion, and we have found that the application of manual handling of invasion areas involves a high initial cost but that in the long term keeping these areas free of invasion involves a very low cost. We hope incorporate the relationship between age and biomass, density and location of each site in order to assess the importance of invasion density, management and subsequent reinvasion.

Most of the work has been done and is being done the analysis and presentation of data, related to experimental field work and the new field work. It is expected to present some of this data in a publication in an international journal. Also, we present in a scientific meeting https://www.jfps-ciap2019.com/ result from the new field work. At the same time, we hope that in the spring we will be able to obtain results on the remaining objectives in order to organise a workshop with the different actors involved in the issue of this project. Also, we hope that the institute (INIBIOMA) will organize the next "open Inibioma", where we interact with the schools of the city and we hope to share the results of this project.