



POTSDAM INSTITUTE FOR
CLIMATE IMPACT RESEARCH

Human-caused fire in Brazilian Grassland

Marie Brunel
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Member of



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Forest and agriculture fire



Journal of Geophysical Research: Biogeosciences

RESEARCH ARTICLE
10.1002/2015JG002914

Forest edge burning in the Brazilian Amazon promoted by escaping fires from managed pastures

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Key Points:

- High-resolution data show fire dominance in land types other than deforested
- Fires escaping from managed pastures highly contribute to forest edge burning
- Fire-deforestation disconnection calls for fire control on managed lands

- Fire trend increased on 59%
- Dissociation between deforestation and fire occurrence
- Existence of escaping fire from managed land

Use of fire on managed grassland

- Resprouting of grass (fire dependency biome)
- Clean grassland from
 - Winter dead biomass
 - Bush and scrub
 - Ticks and bugs
- Economical reasons

In Pampas:

- Natural grassland
- C4 grasses
- Mosaic distribution
- Fire dependent

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Research Letters
The South Brazilian grasslands – A South American tallgrass prairie? Parallels and implications of fire dependency

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^c Ecosystem Science and Management Department, University of Wyoming, Laramie, USA
^d Natural Resource Ecology and Management, Oklahoma State University, Stillwater, USA



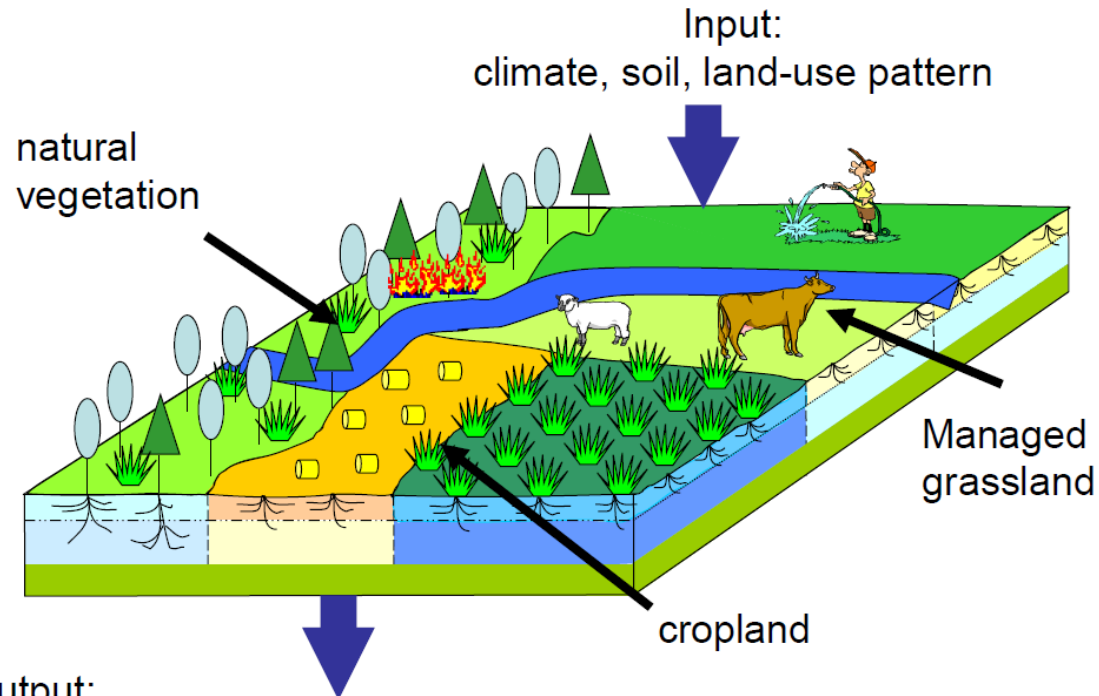


Use of fire on managed grassland



LPJmL: Global Vegetation Model

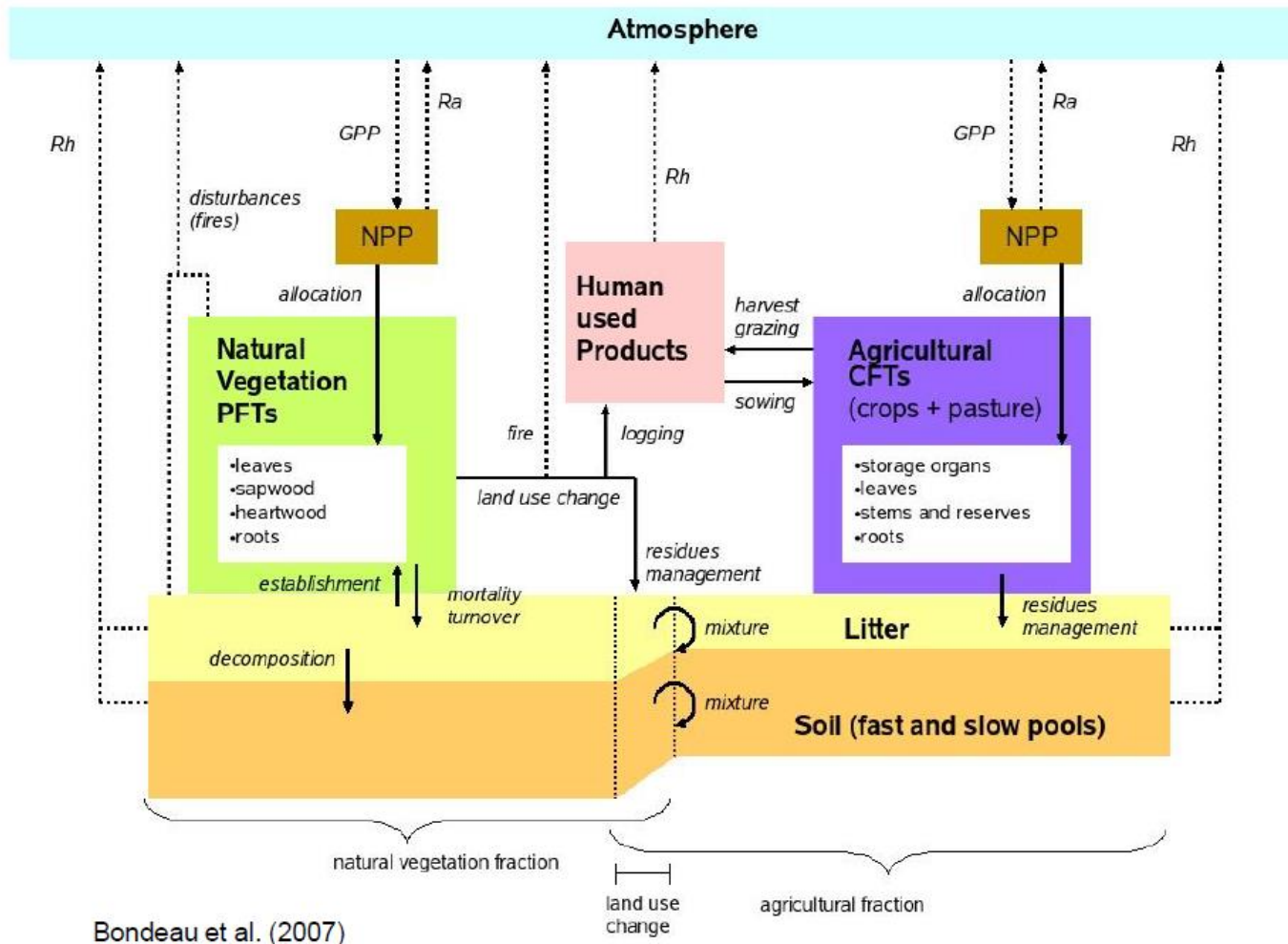
- BIOME model + vegetation dynamics : mortality, competition, disturbance
- LPJmL (managed Land): LPJ + crops + irrigation + SPITFIRE
Programmed in C,
- repository managed at PIK + Open source



Output:

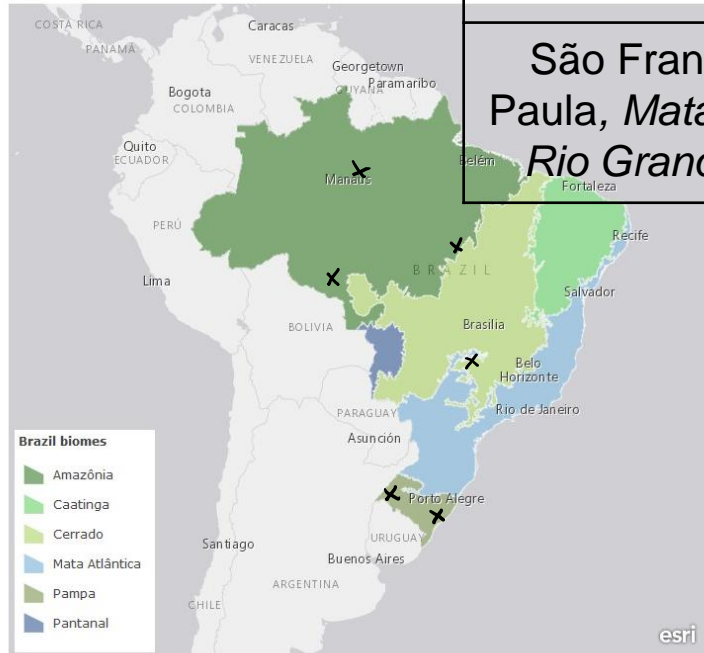
- C- and H₂O flows and pools
- Vegetation patterns
- Agricultural data: yields, residues, water, carbon

LPJmL: Global Vegetation Model



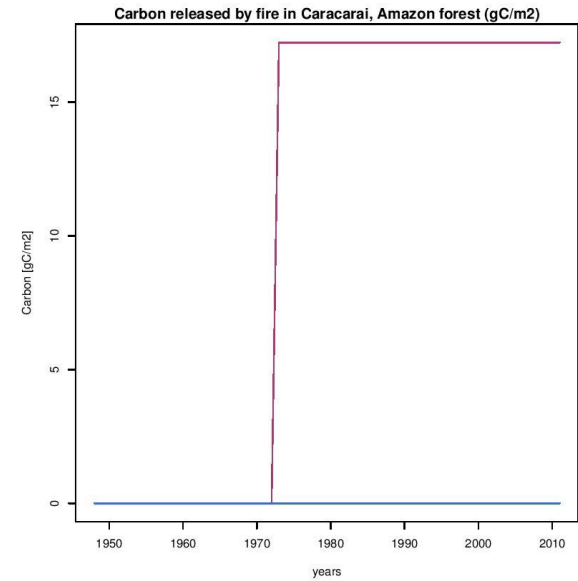
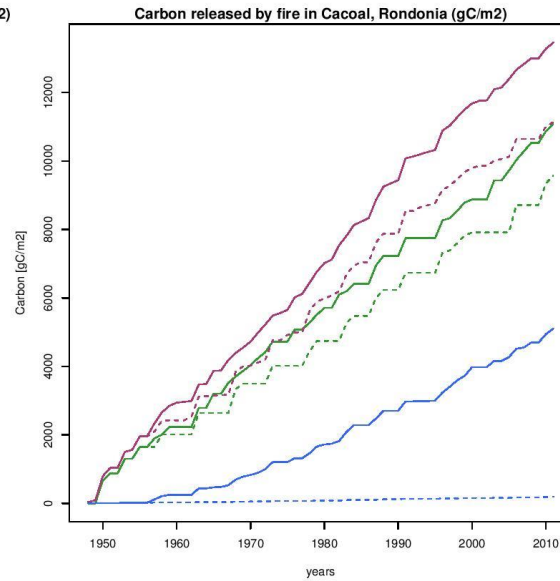
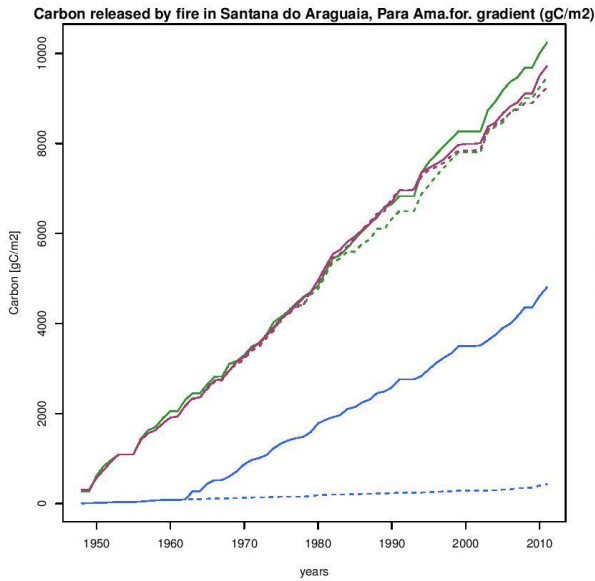
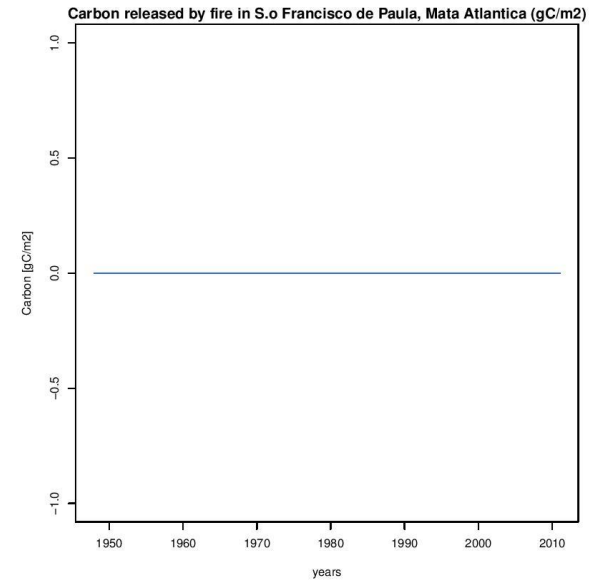
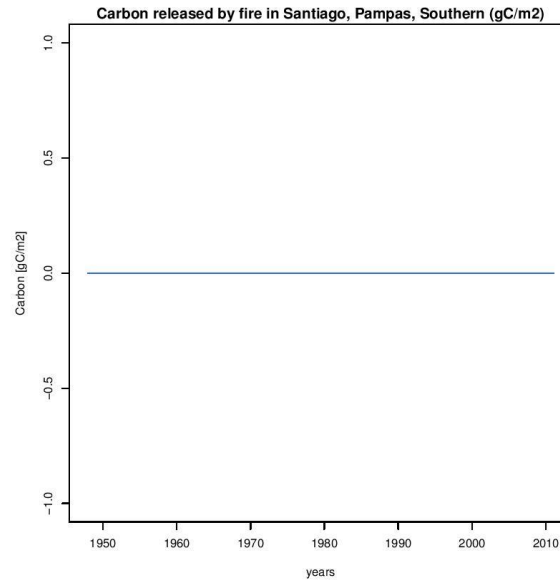
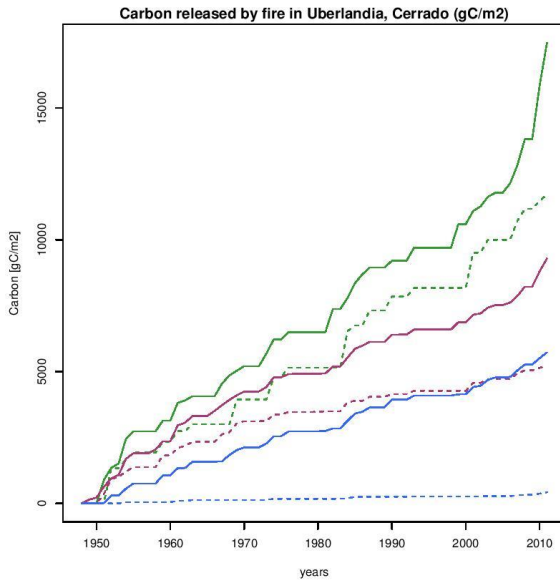
First outputs with SPITFIRE on grassland

Natural vegetation only	Land-use	Managed grassland only
Natural fires only		Natural and human-caused fires
SPITFIRE module on natural vegetation and managed grassland		
Global simulation		
Uberlândia, <i>Minas Gerais,</i> <i>Cerrado</i>	Santana do Araguaia, <i>Para, Amazon Forest</i> <i>and Cerrado interface</i>	Cacoal, <i>Rondônia,</i> <i>Amazon Forest</i>
São Francisco de Paula, <i>Mata Atlântica,</i> <i>Rio Grande do sul</i>	Santiago, <i>Pampas,</i> <i>Rio Grande do sul</i>	Caracarai, <i>Amazon forest</i>



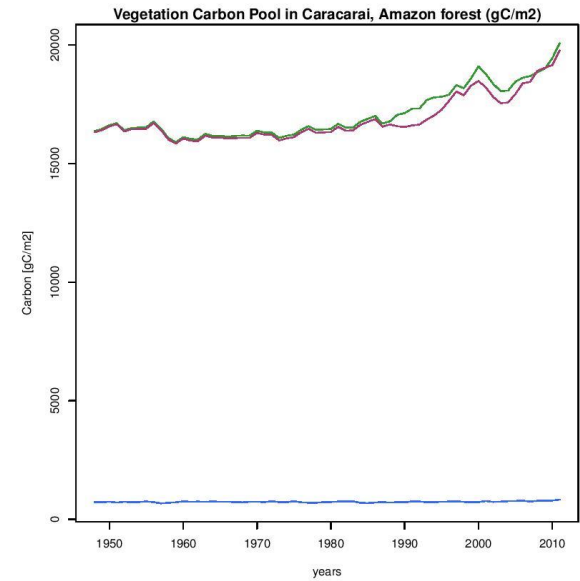
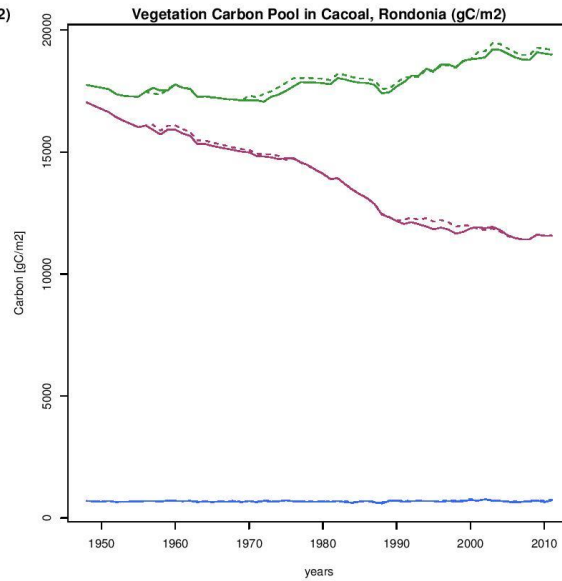
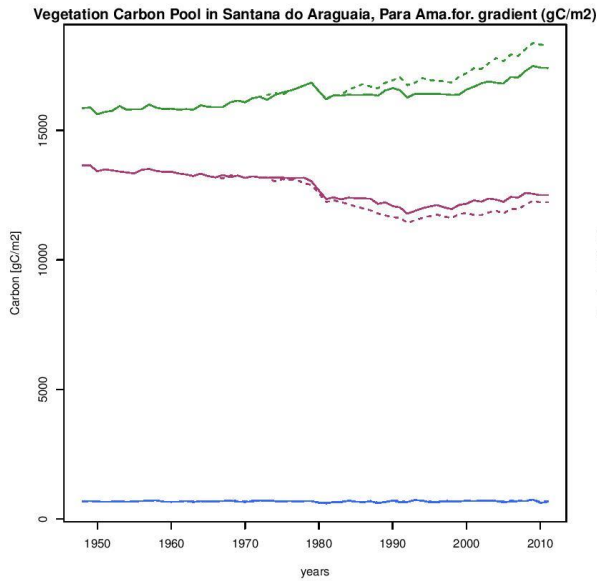
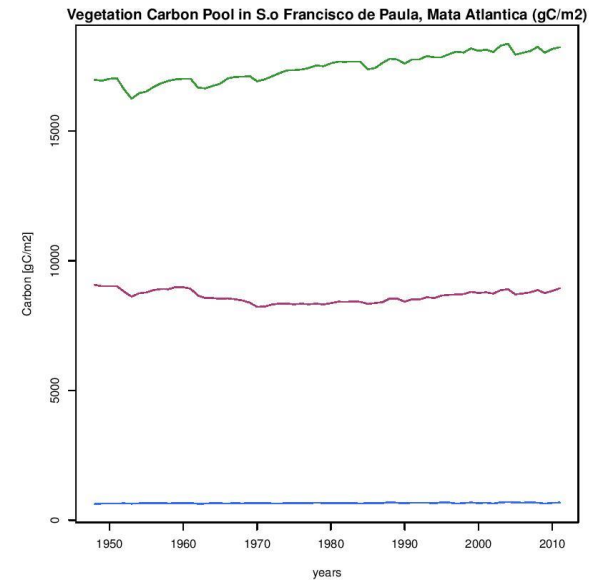
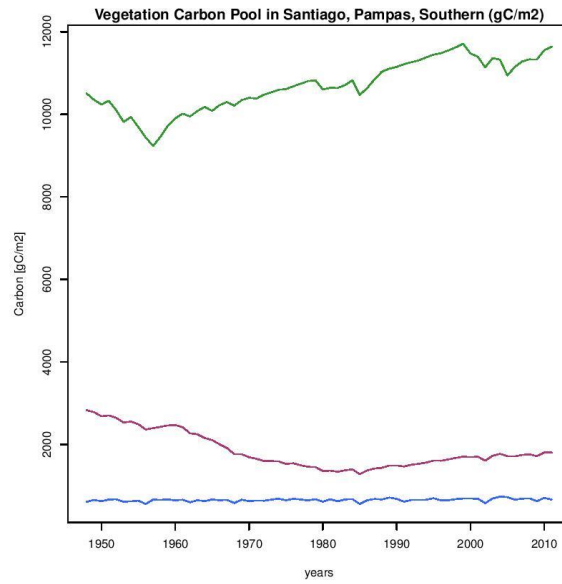
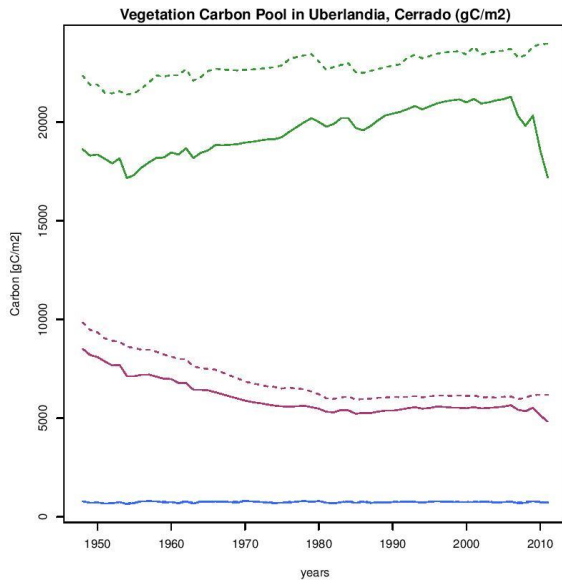
Cumulative Carbon released by fire

- Only Natural Vegetation
- Landuse
- All managed Grassland
- - - Only Natural Fire
- Natural and Human-caused Fire



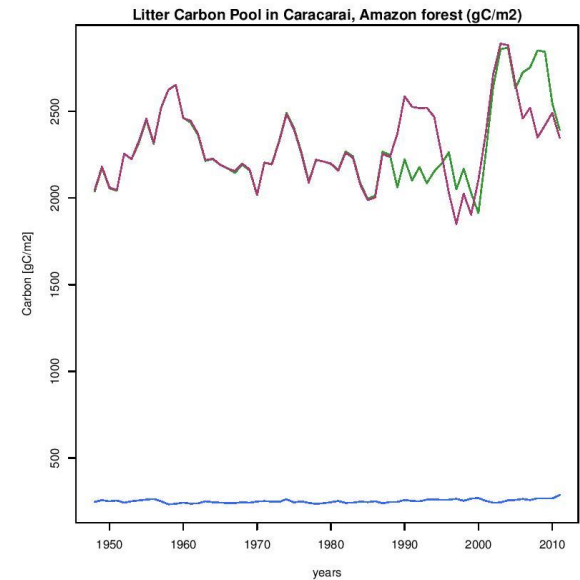
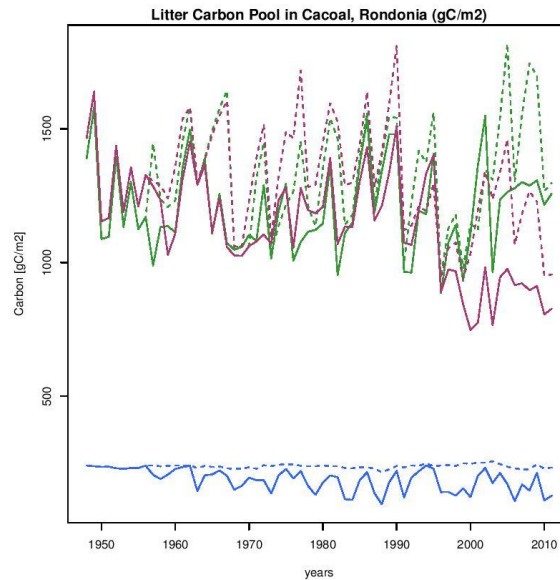
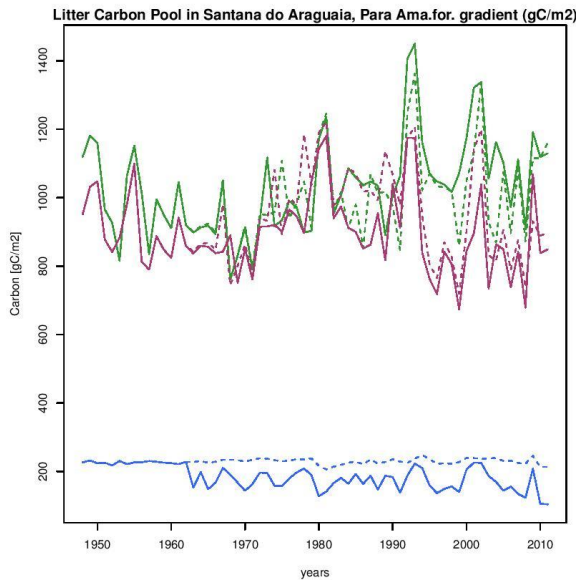
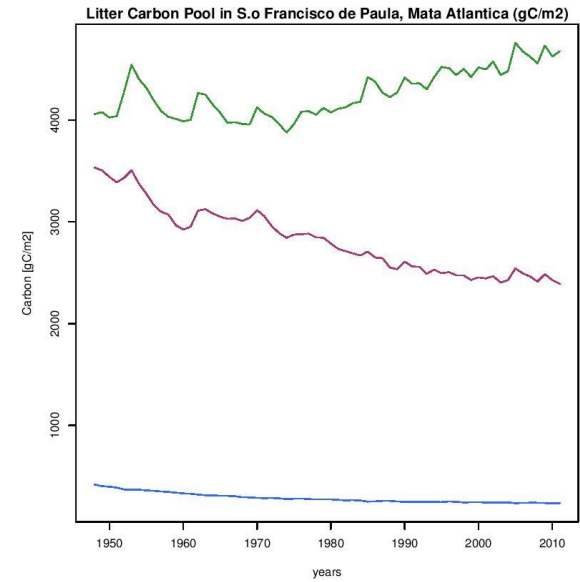
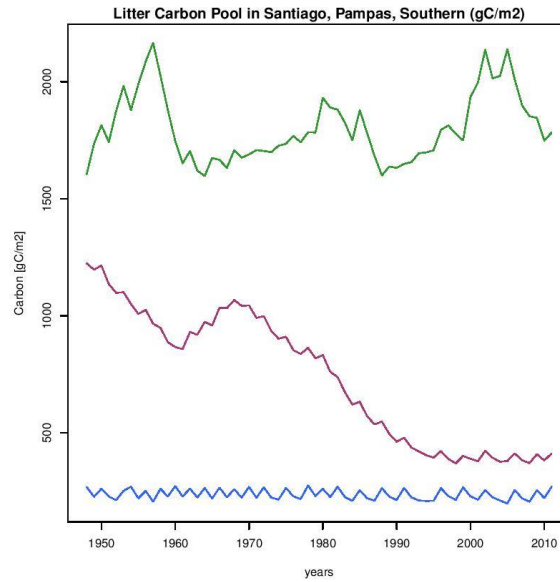
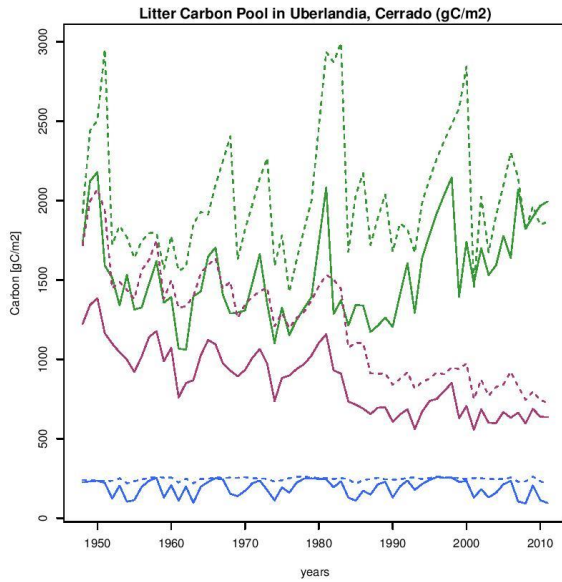
Vegetation carbon pool

- Only Natural Vegetation
- Landuse
- All managed Grassland
- - - Only Natural Fire
- Natural and Human-caused Fire



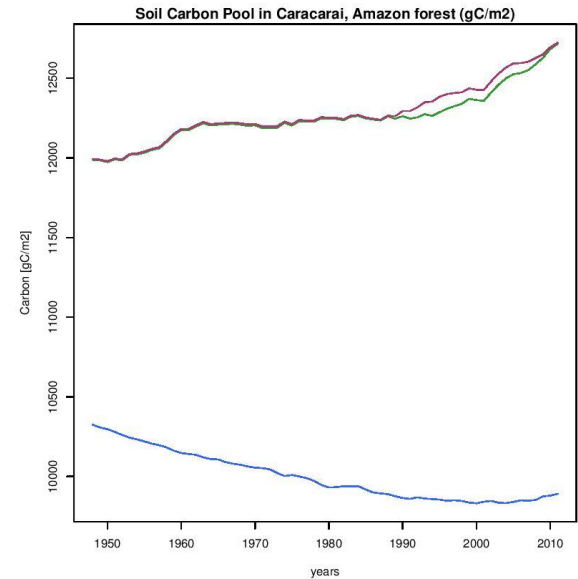
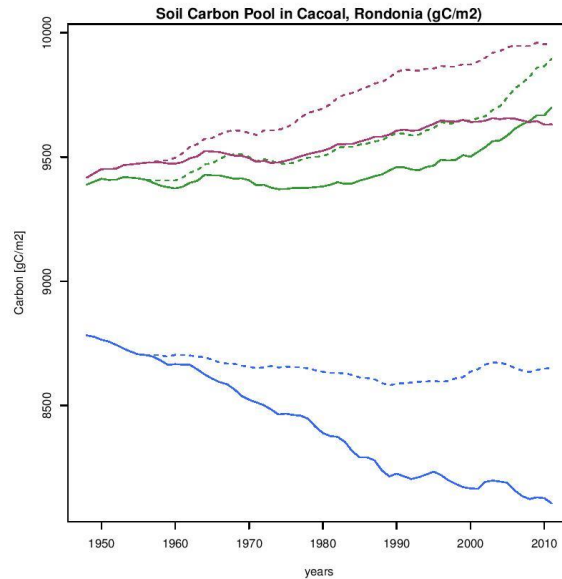
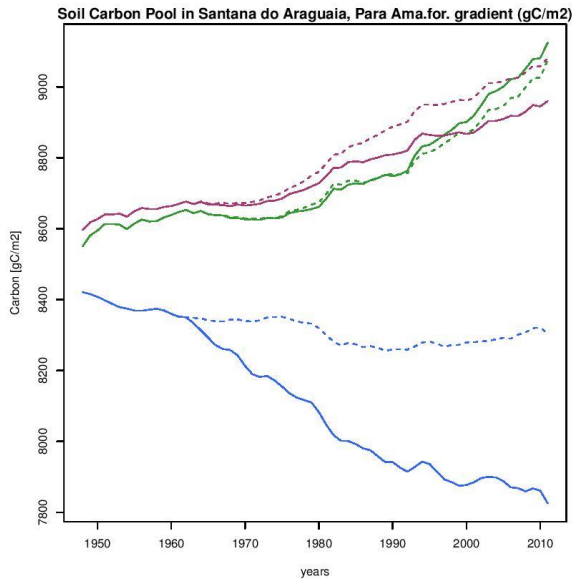
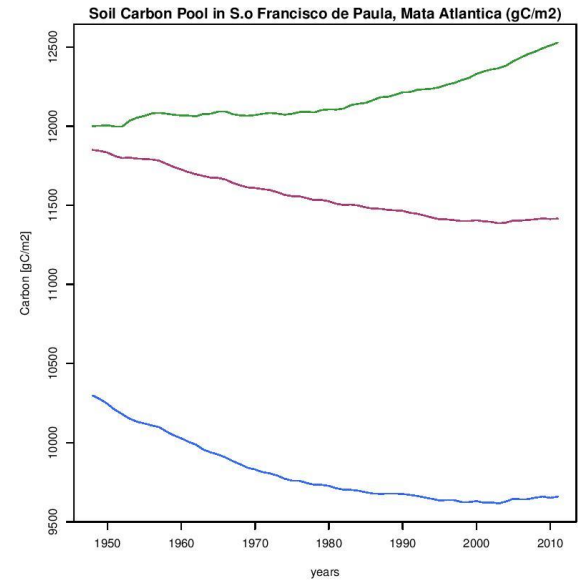
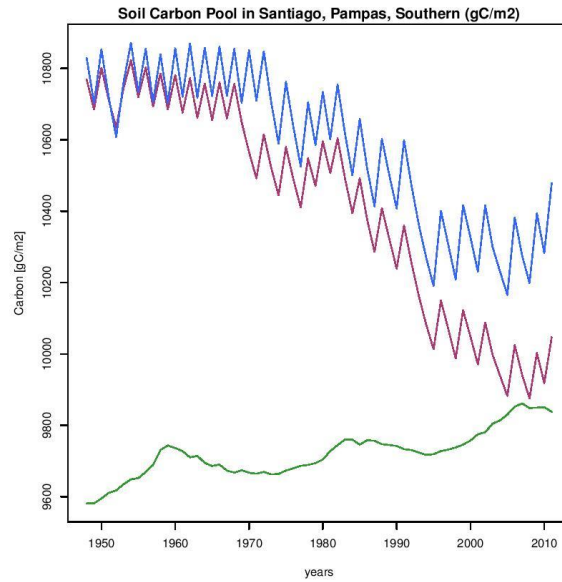
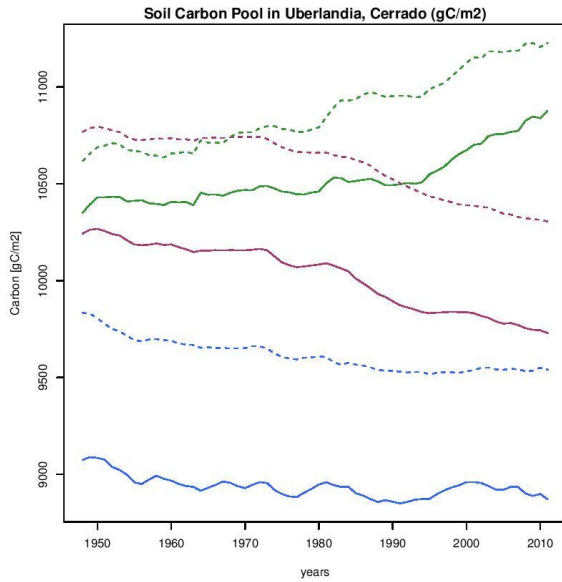
Litter carbon pool

- Only Natural Vegetation
- Landuse
- All managed Grassland
- - - Only Natural Fire
- Natural and Human-caused Fire

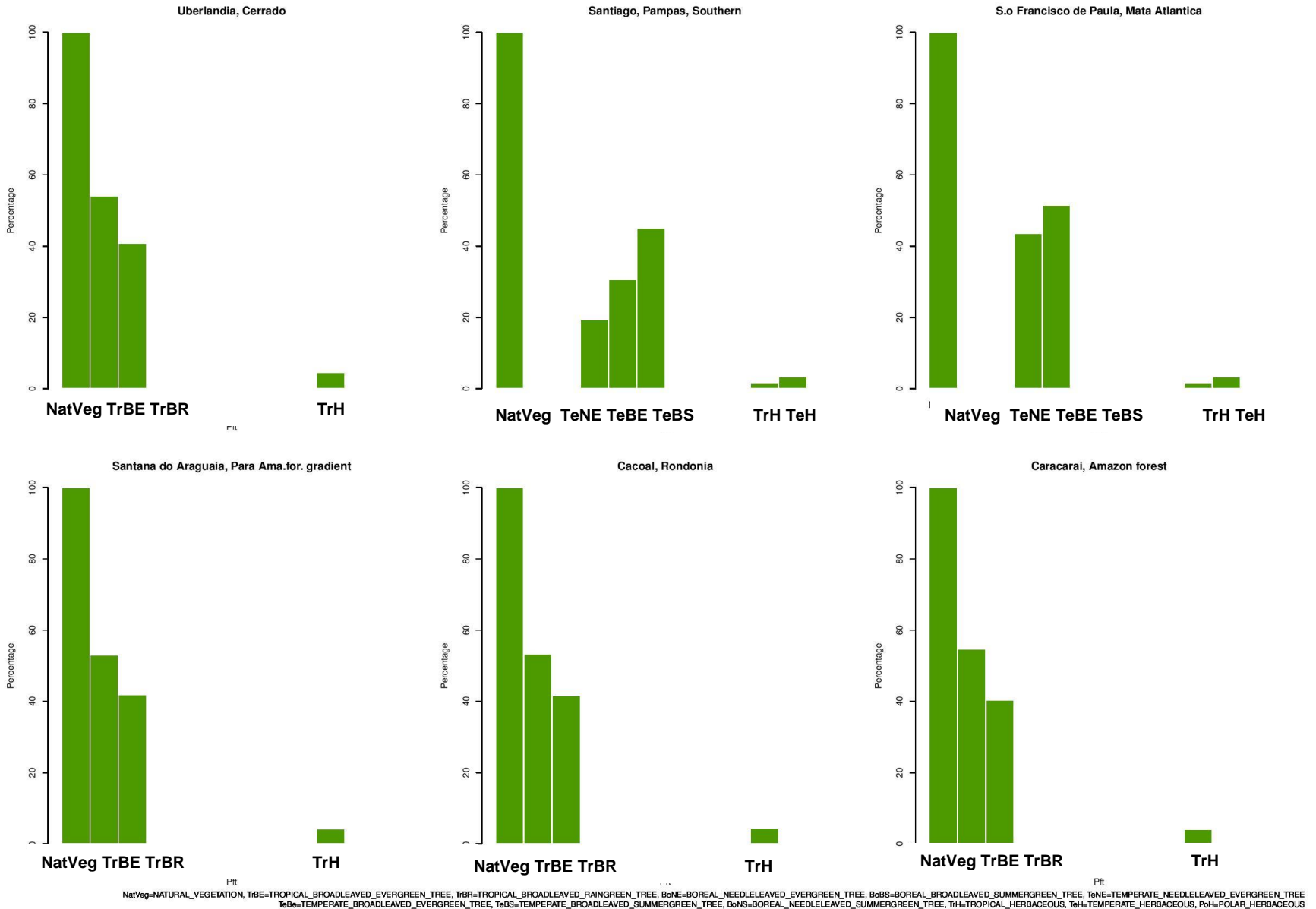


Soil carbon pool

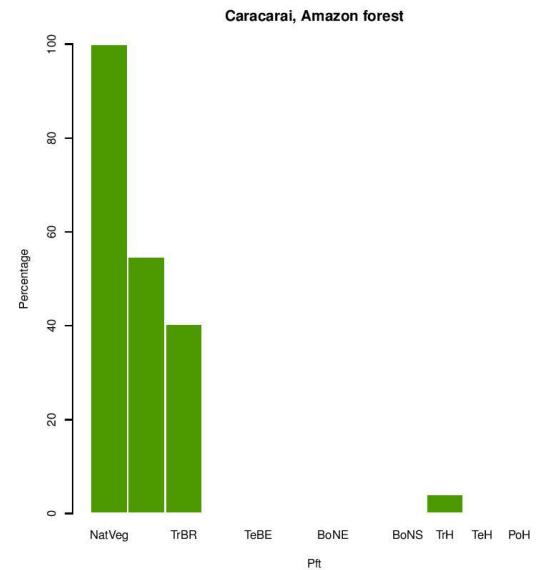
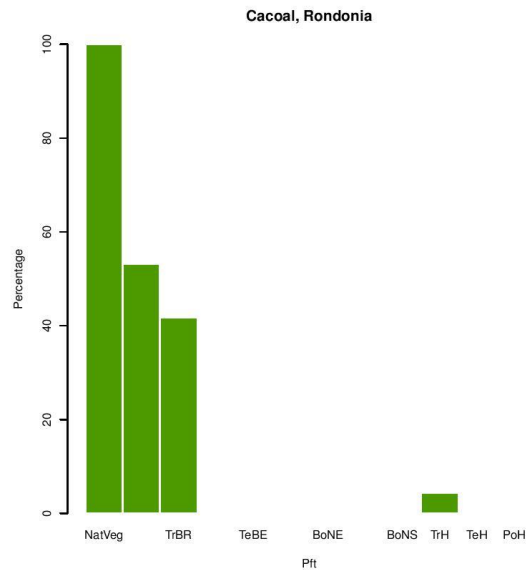
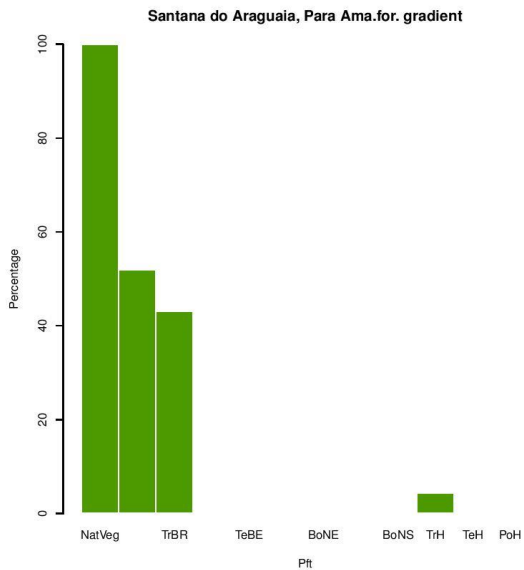
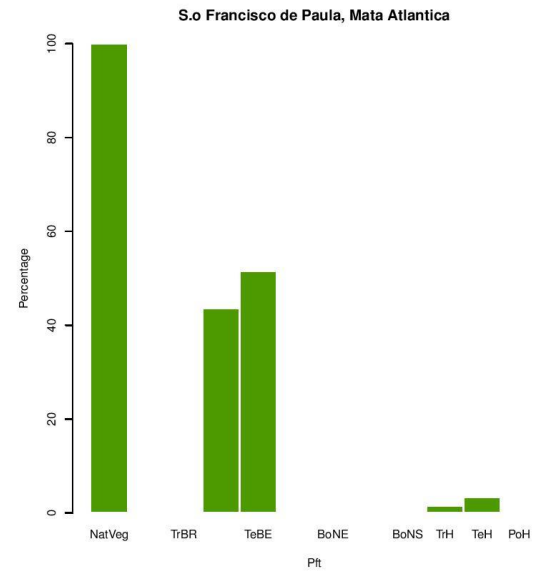
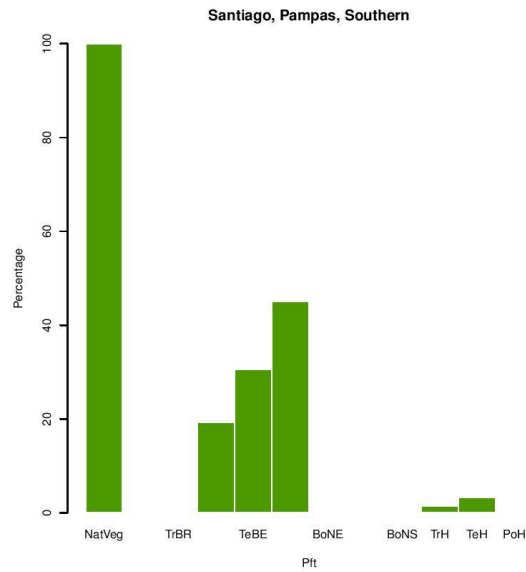
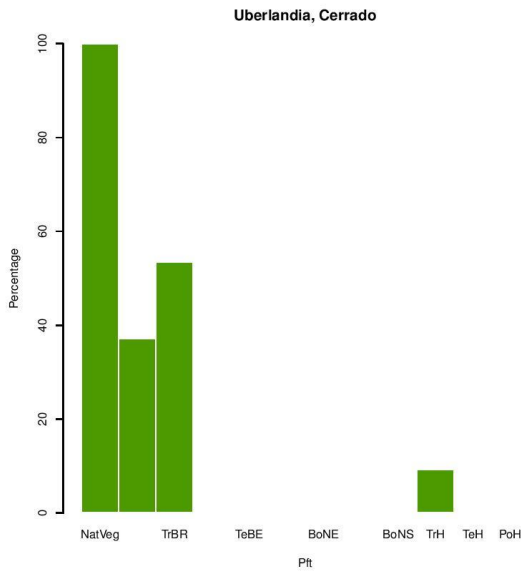
- Only Natural Vegetation
- Landuse
- All managed Grassland
- - - Only Natural Fire
- Natural and Human-caused Fire



Foliage projected cover, NatVeg NatFire

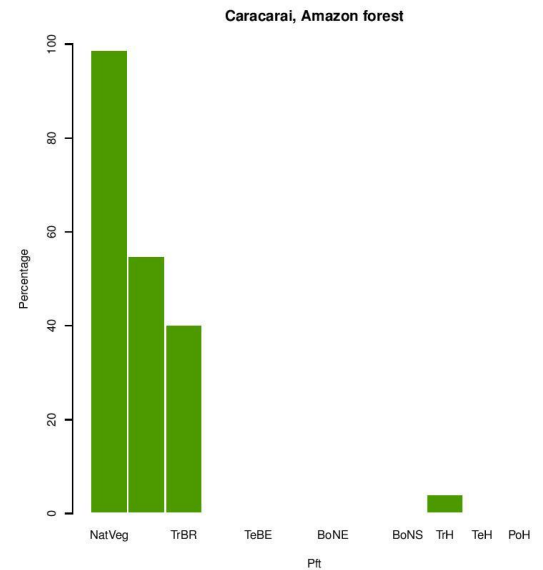
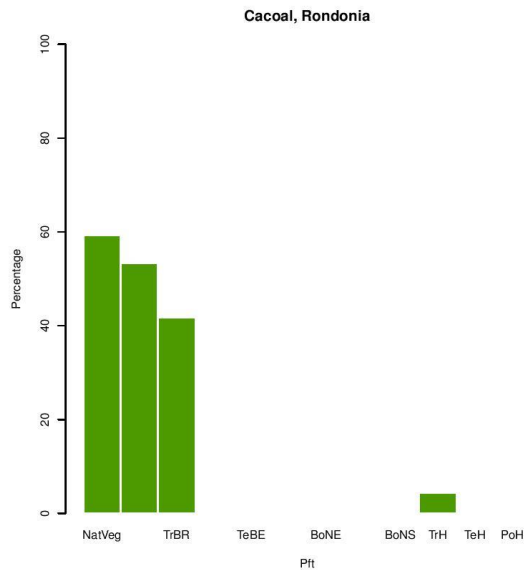
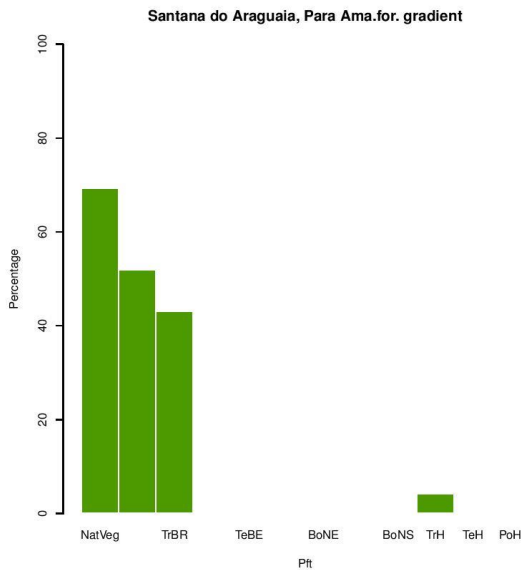
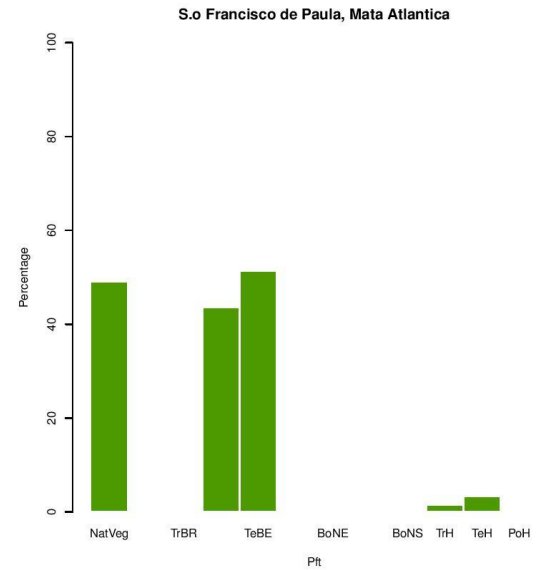
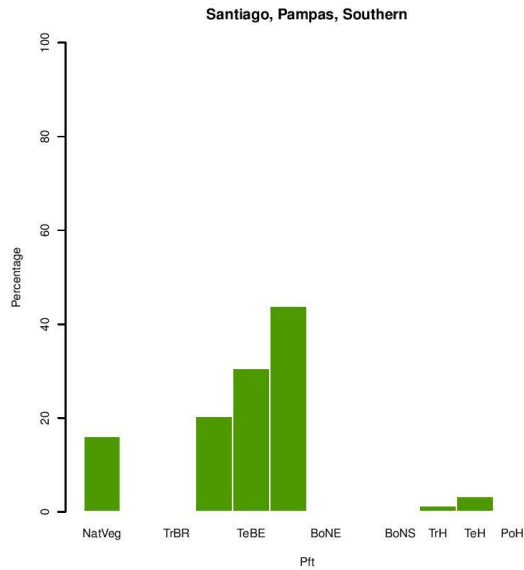
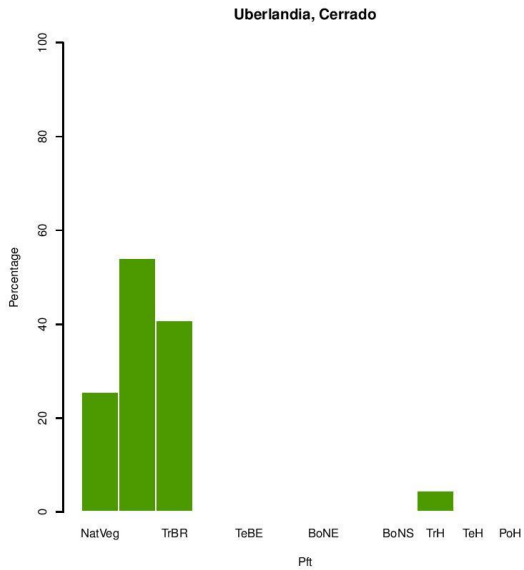


Foliage projected cover, NatVeg Nat+HumFire

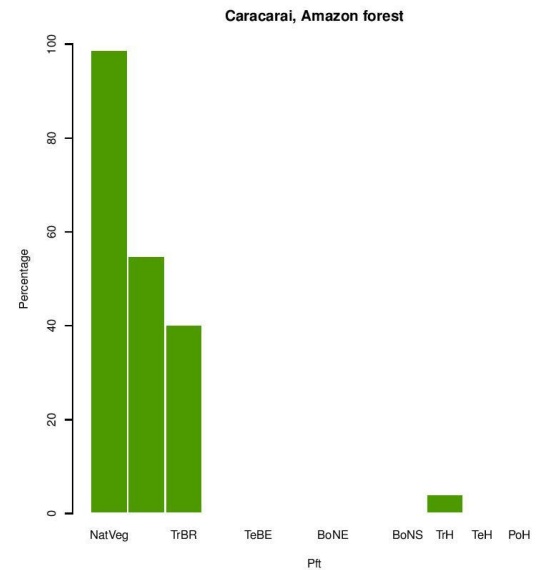
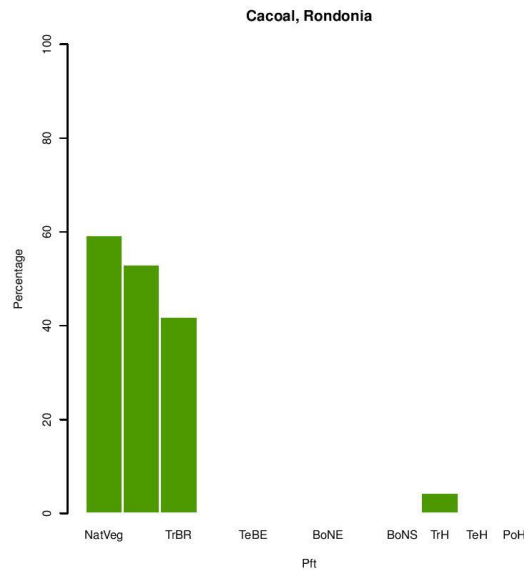
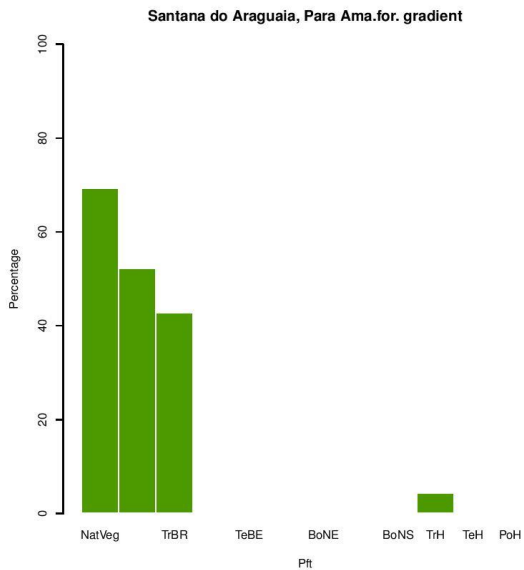
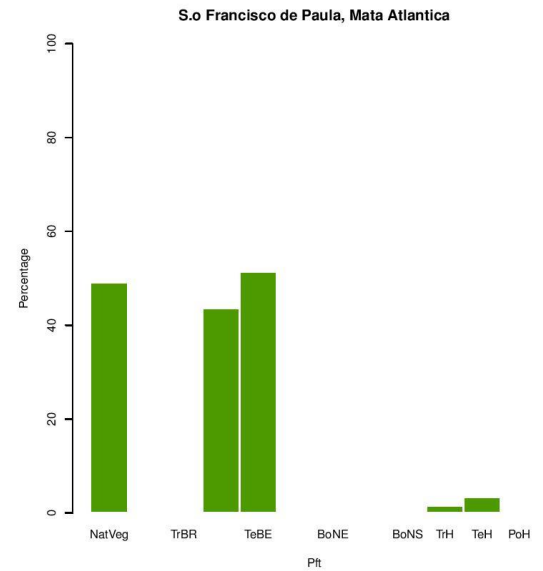
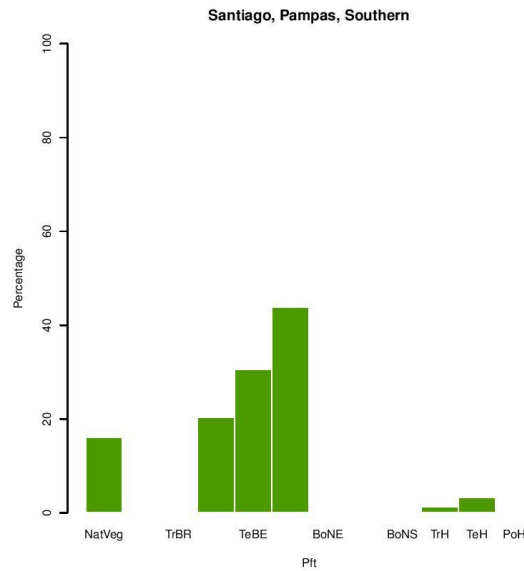
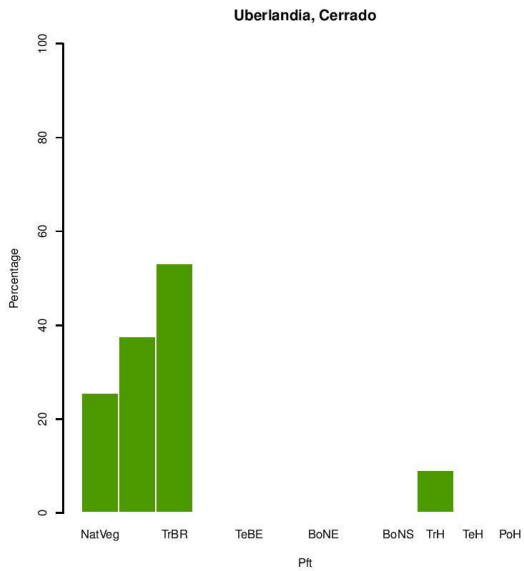


NatVeg=NATURAL_VEGETATION, TrBE=TROPICAL_BROADLEAVED_EVERGREEN_TREE, TrBR=TROPICAL_BROADLEAVED_RAINGREEN_TREE, BoNE=BOREAL_NEEDLELEAVED_EVERGREEN_TREE, BoBS=BOREAL_BROADLEAVED_SUMMERGREEN_TREE, TeNE=TEMPERATE_NEEDLELEAVED_EVERGREEN_TREE, TeBE=TEMPERATE_BROADLEAVED_EVERGREEN_TREE, TeBS=TEMPERATE_BROADLEAVED_SUMMERGREEN_TREE, BoNS=BOREAL_NEEDLELEAVED_SUMMERGREEN_TREE, TrH=TROPICAL_HERBACEOUS, TeH=TEMPERATE_HERBACEOUS, PoH=POLAR_HERBACEOUS

Foliage projected cover, Landuse NatFire

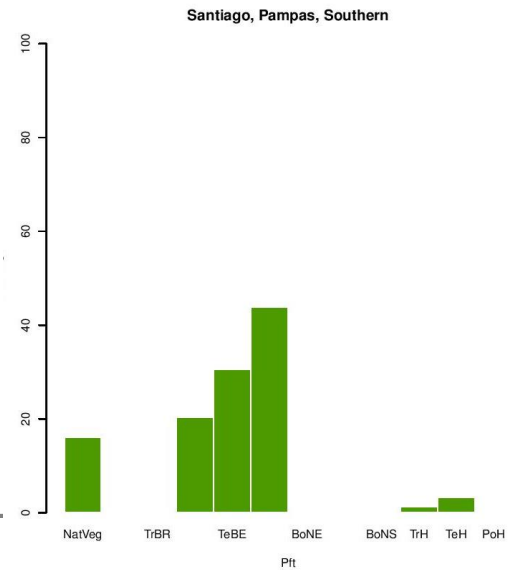
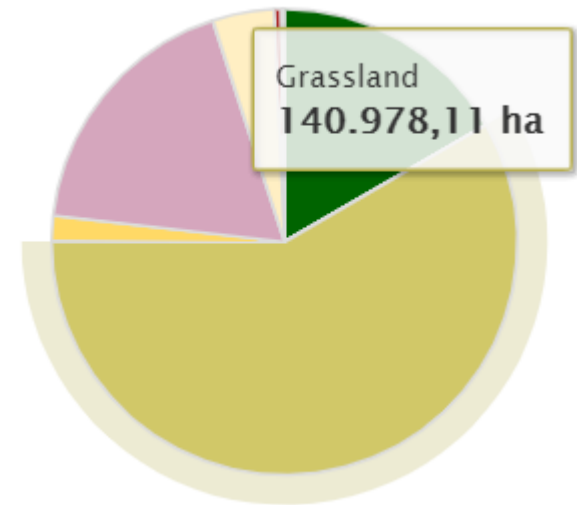
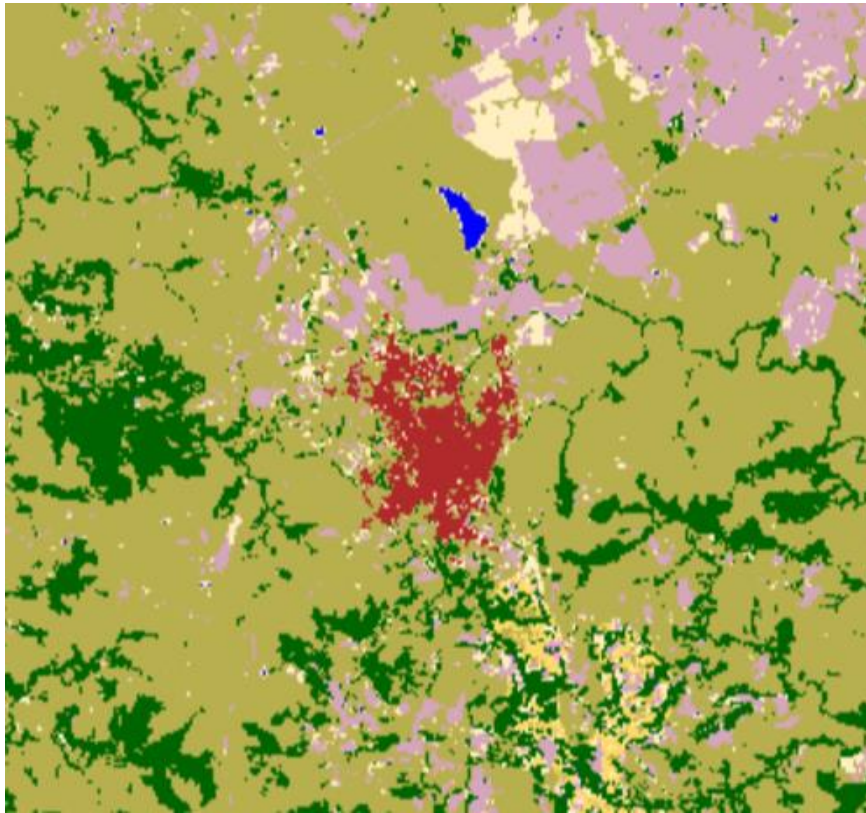


Foliage projected cover, Landuse Nat+HumFire



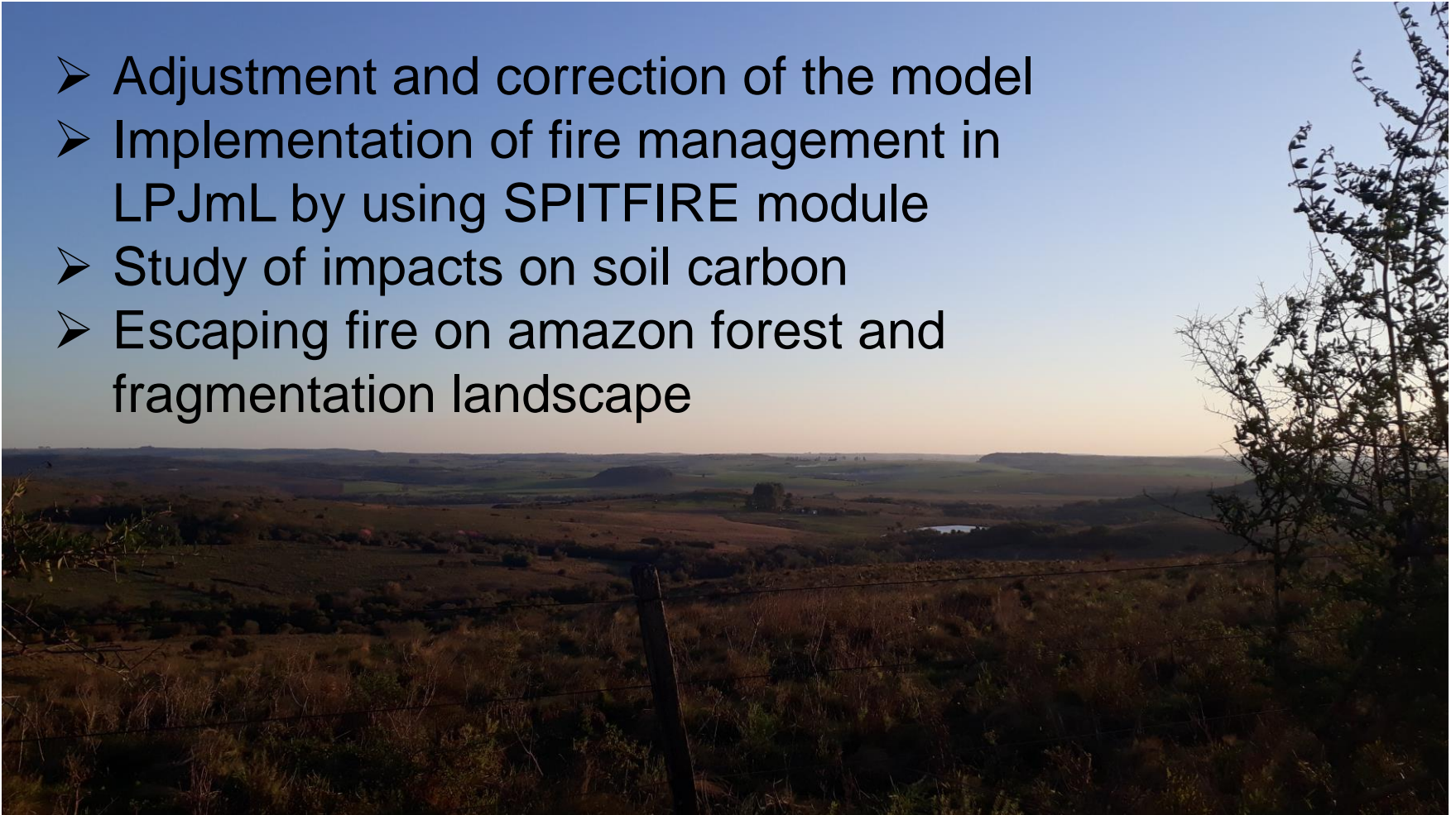
NatVeg=NATURAL_VEGETATION, TrBR=TROPICAL_BROADLEAVED_RAINGREEN_TREE, TeBE=TROPICAL_BROADLEAVED_EVERGREEN_TREE, BoNE=BOREAL_NEEDLELEAVED_EVERGREEN_TREE, BoNS=BOREAL_BROADLEAVED_SUMMERGREEN_TREE, TrH=TROPICAL_HERBACEOUS, TeH=TEMPERATE_NEEDLELEAVED_EVERGREEN_TREE, PoH=POLAR_HERBACEOUS

Santiago Rio Grande du Sol



What next ?

- Adjustment and correction of the model
- Implementation of fire management in LPJmL by using SPITFIRE module
- Study of impacts on soil carbon
- Escaping fire on amazon forest and fragmentation landscape



Main structure of LPJ

- **Modular structure**
- **Starts simulation from bare ground**
 - Finds equilibrium between vegetation, soil and climate for each grid cell
- **Carbon and water balance**

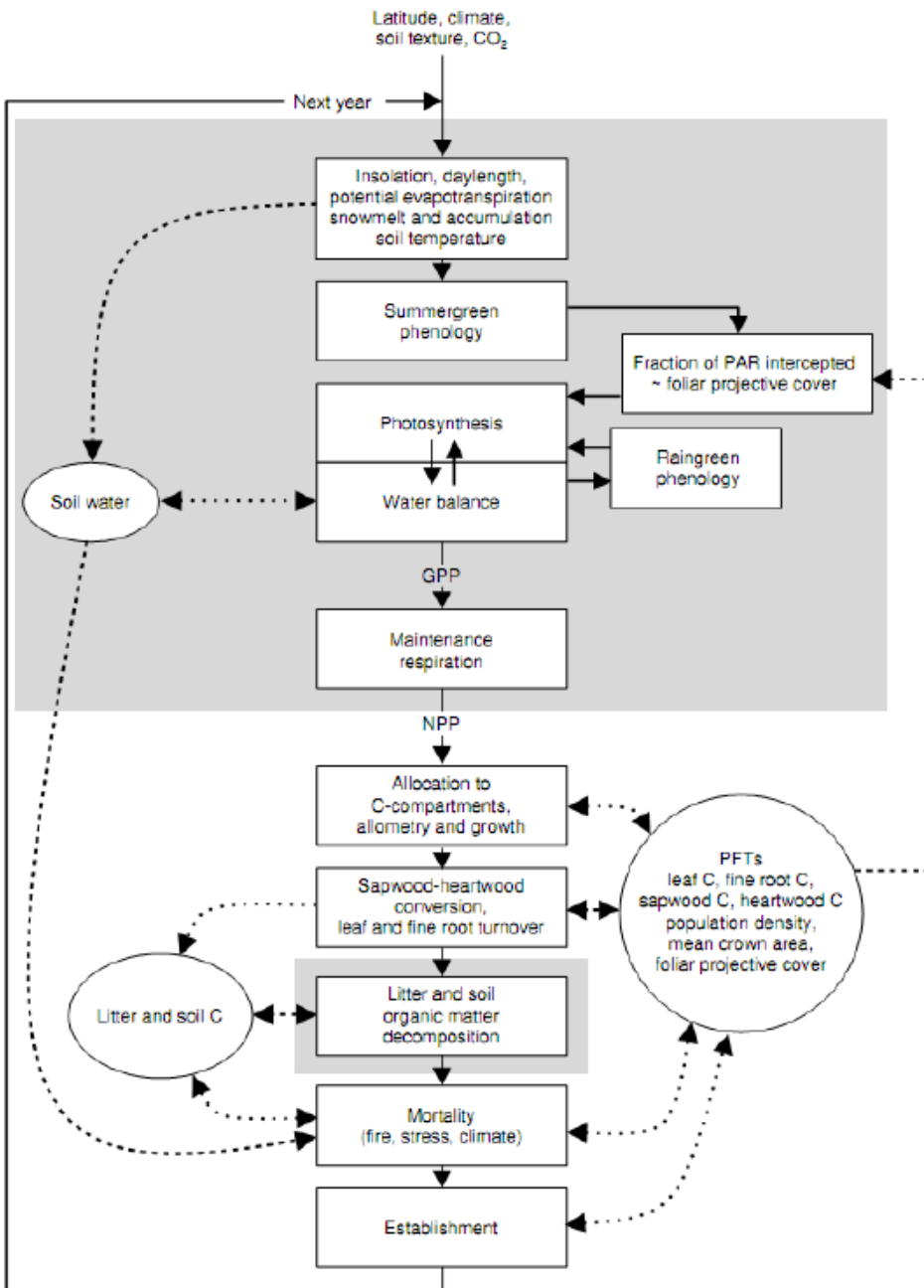


Fig. 1 A flowchart describing the order individual process representations (in boxes), known as modules, are performed (solid lines) in all grid cells, during one simulation year. The dashed lines represent exchange of information between vegetation and soil state variables and the individual modules, with arrows representing the direction of information flow. Modules with a shaded background are called on a daily or monthly time step, the remainder called annually.