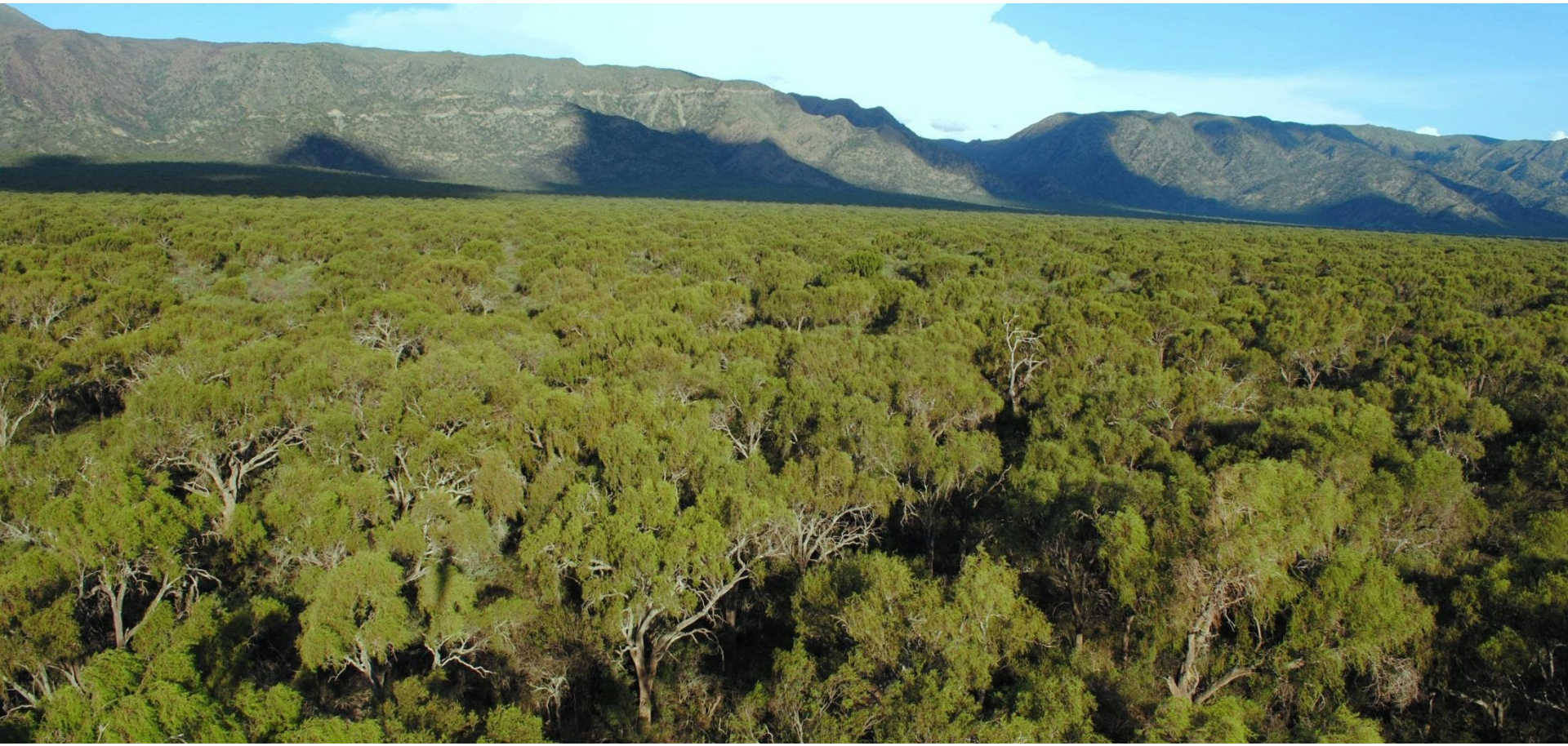
Large effects of land use conversion on C storage in dry forest ecosystems from southern South America



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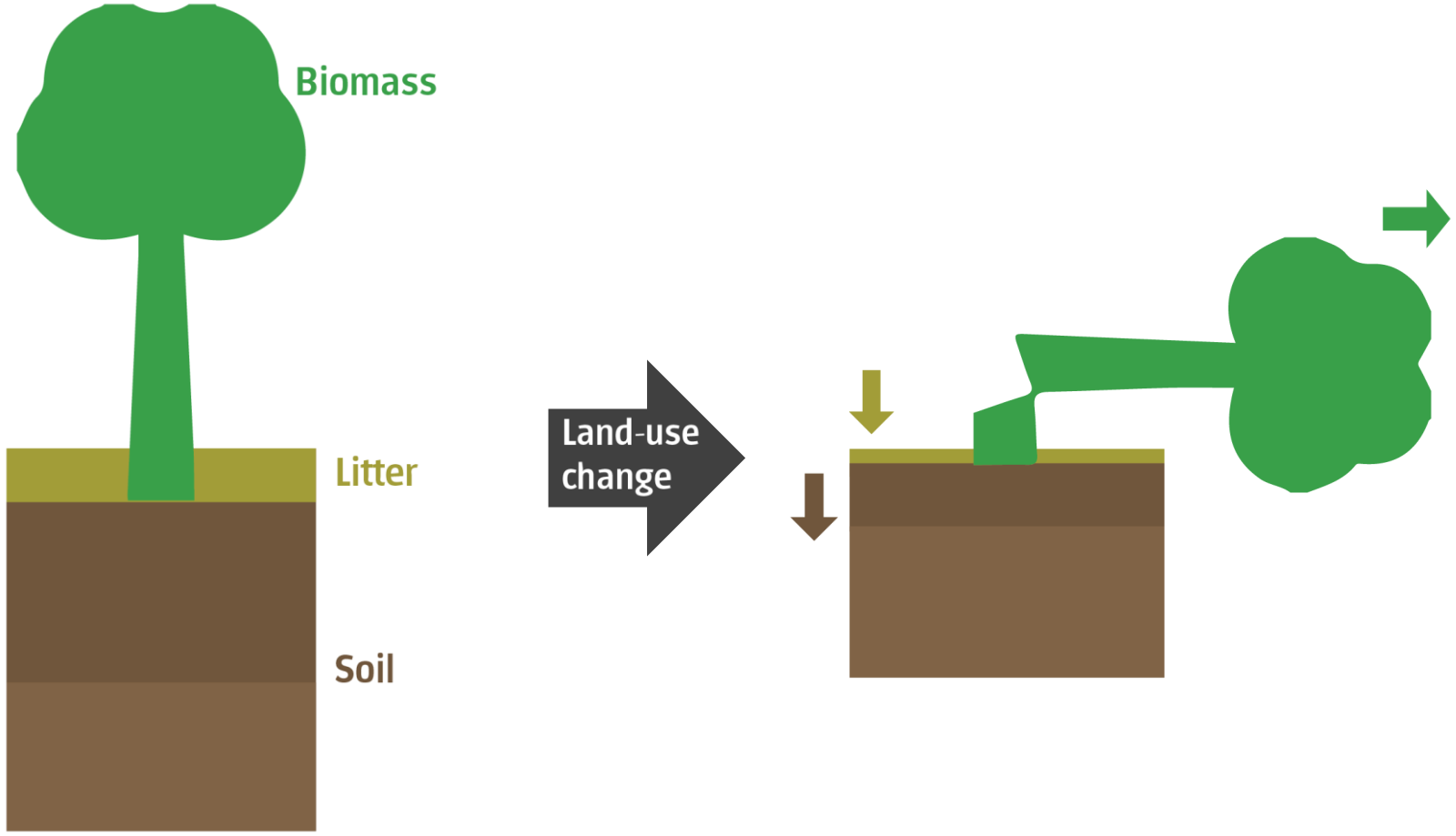
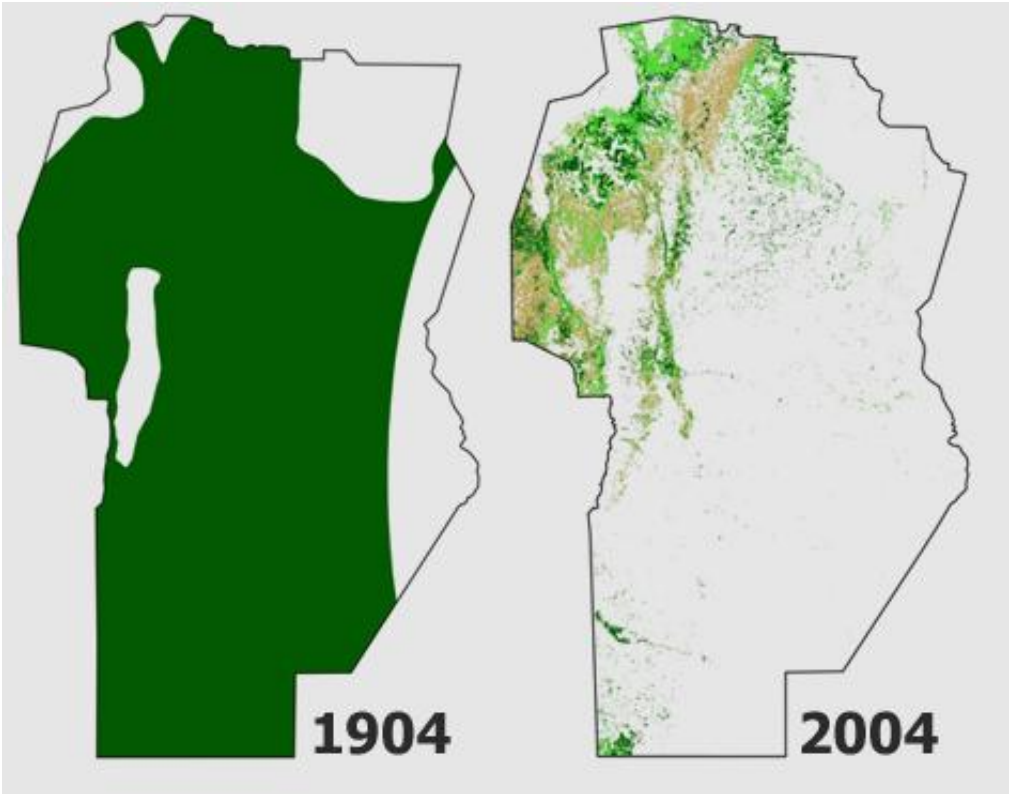
How does land-use change affect ecosystems C storage?



Regional land-use changes. Actual situation

Forest cover changes in central Argentina



Annual deforestation rate for the area (1969-1999): **2.2%**

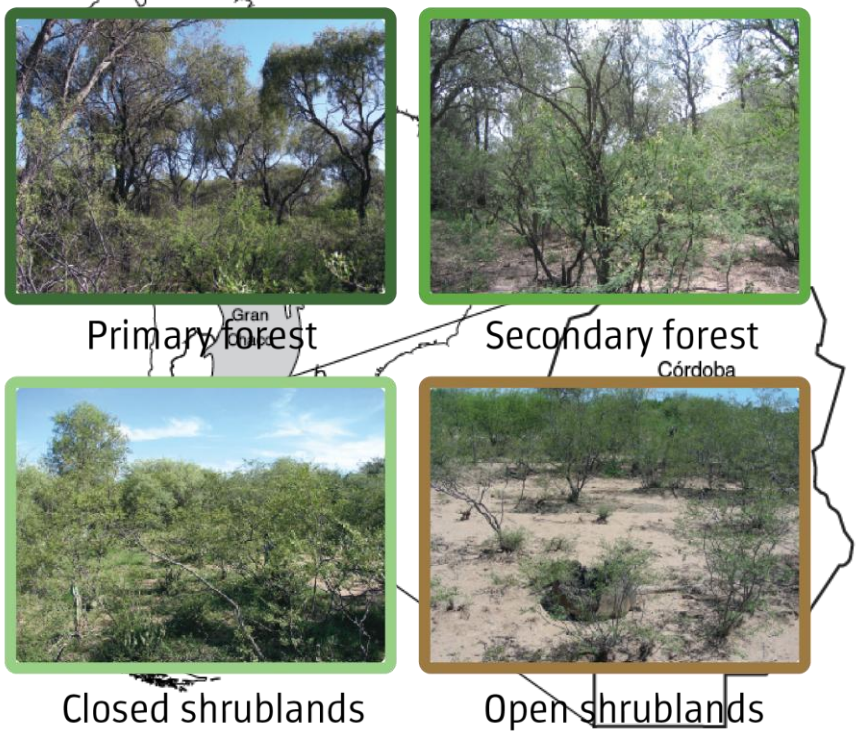
Zak et al Biol Cons, 2004

The research presented here aimed to answer the following questions:

i) How much C is stored in plant and soil pools under different land-uses in the semi-arid Chaco of Argentina?

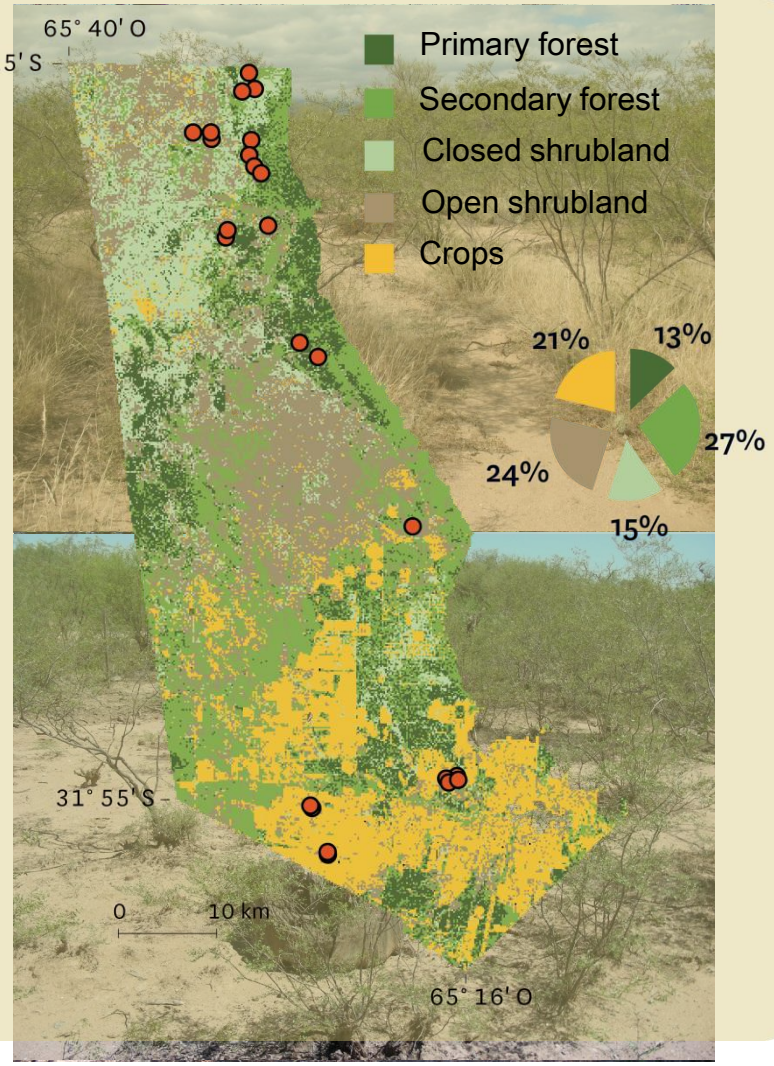
ii) Which is the direction and magnitude of change in C pools associated to common land-use transitions in the area?

Study area



n = 4

spring – summer)



Quantifying CS in the dry Chaco

DBH, H and WSD

Crown area, weight, ramifications

(n = 658) basal diameter (n = 772)

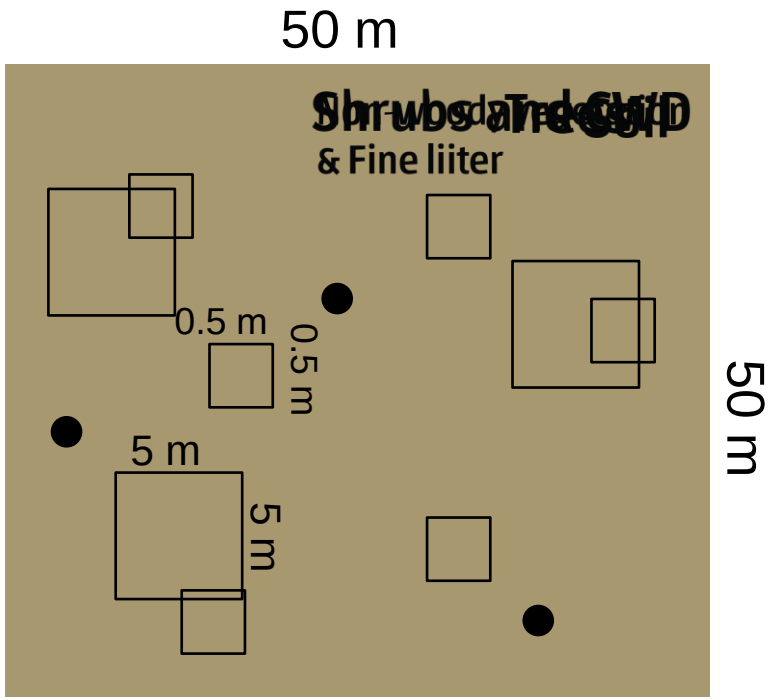
SOC (Mg ha^{-1}) = BD x depth x OC, corrected by changes in bulk density (Wendt & Hauser, 2013)

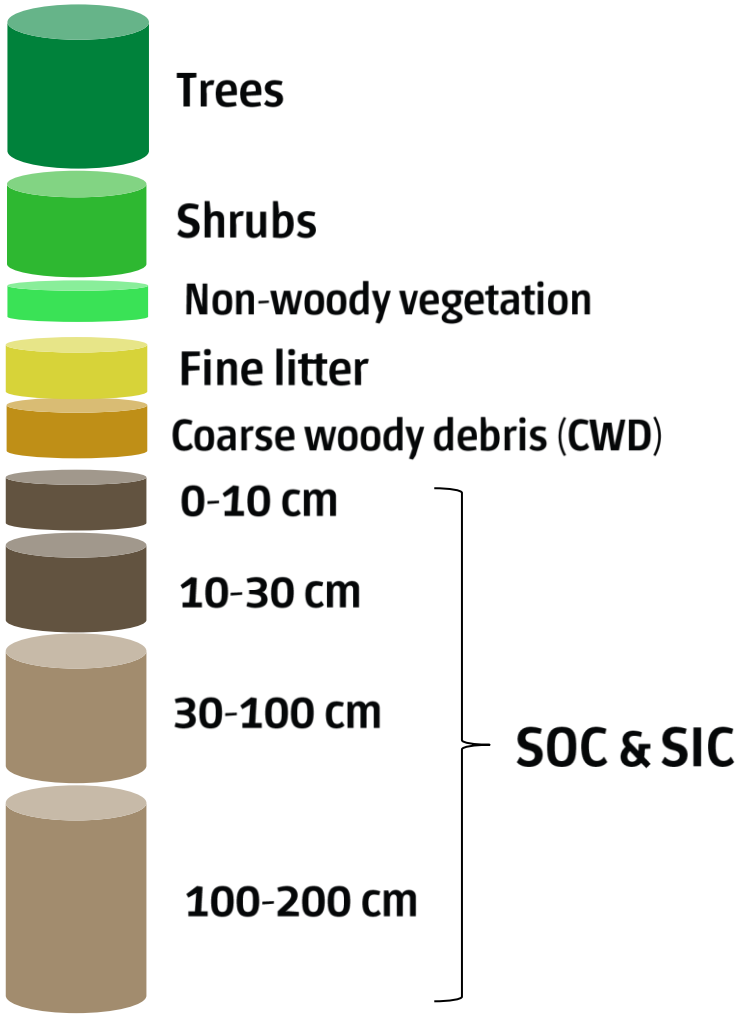
ASB (kg) = exp(-2.187 + 0.916 Ln(WSD^2* DBH^2* H))

Chaco species specific biomass equations

SIC (Mg ha^{-1}) = BD x depth x IC, corrected by changes in bulk density (Wendt & Hauser, 2013)

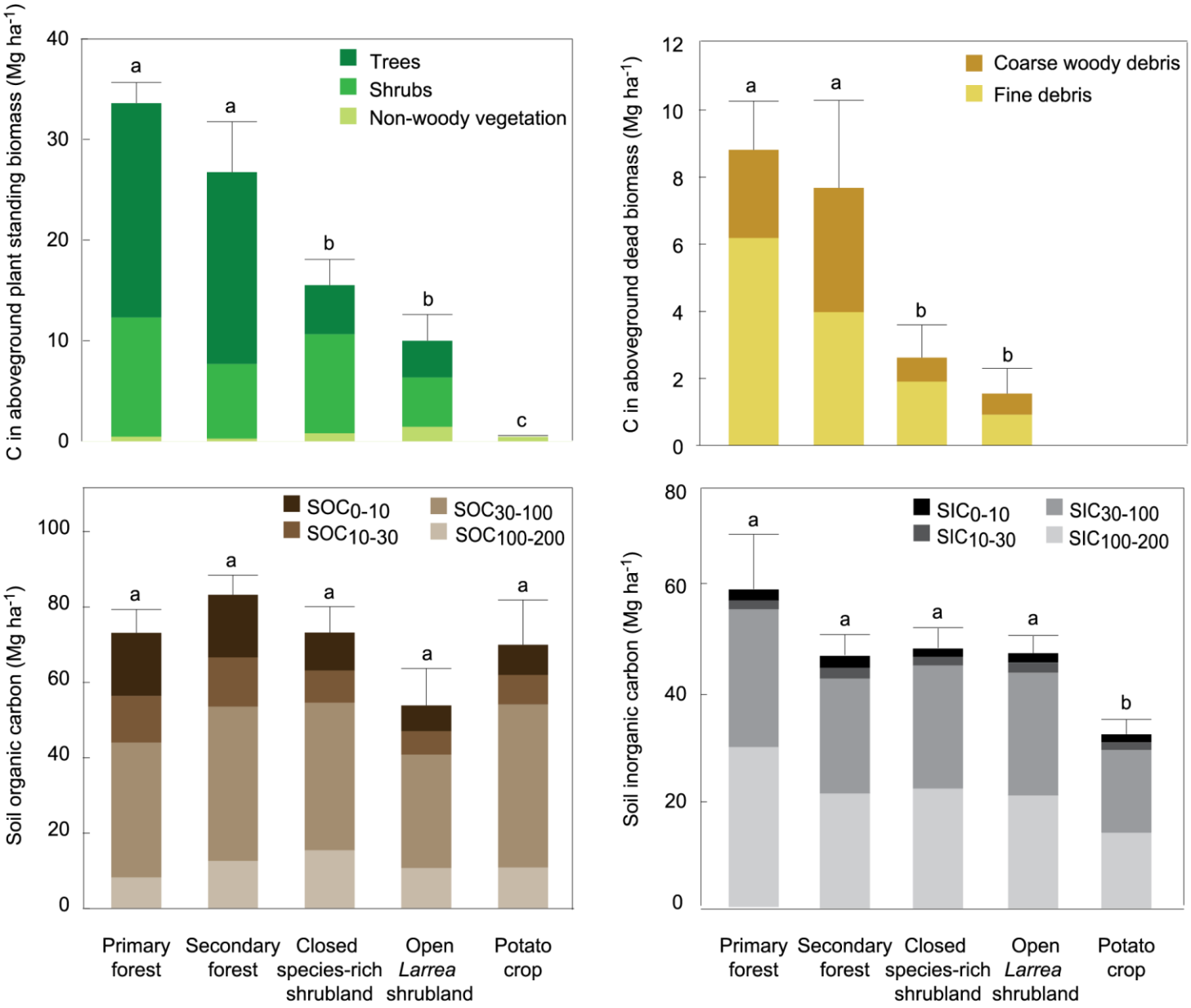
Inorganic C measured as carbonate calcium





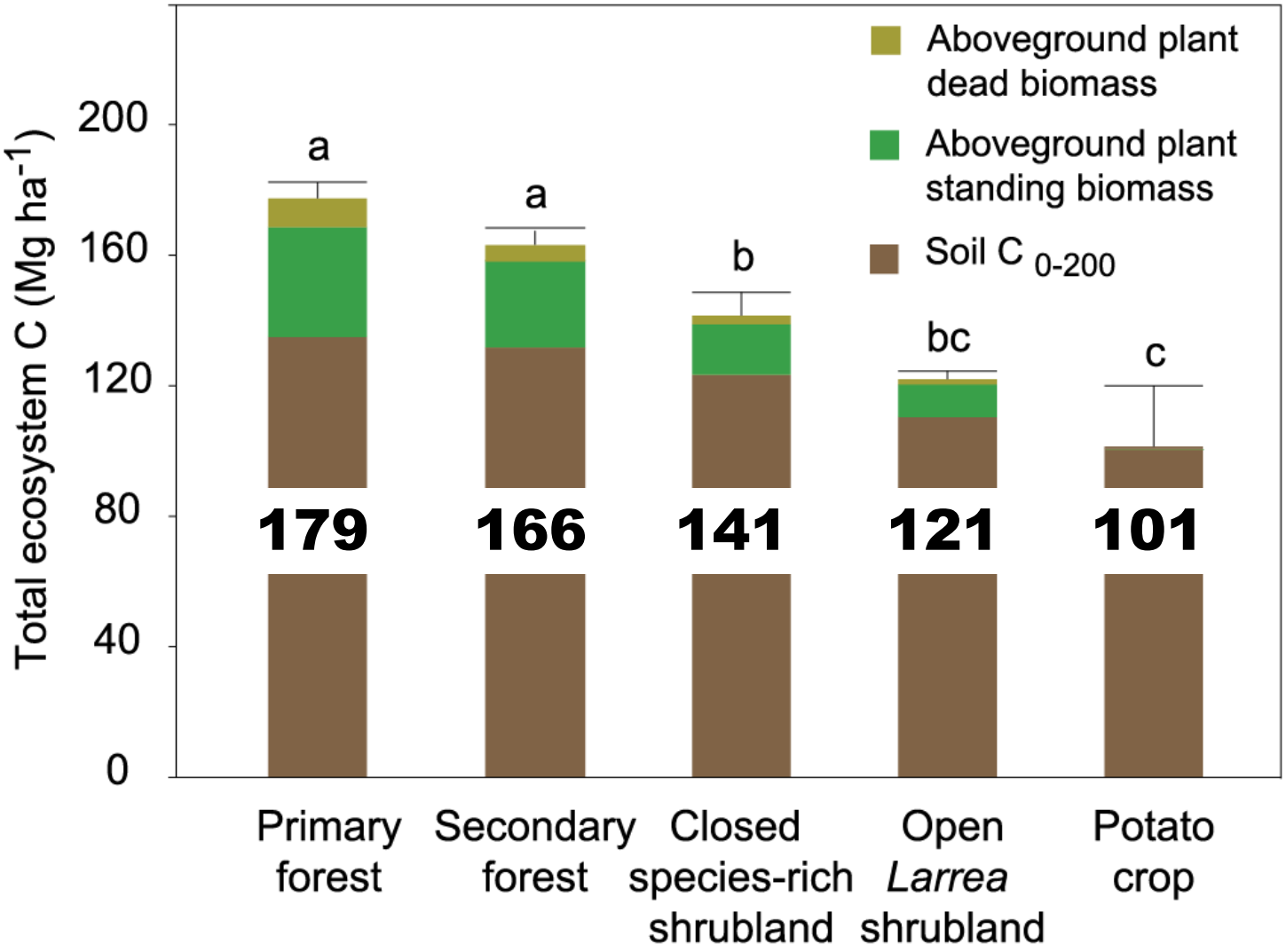
Conti et. al Ann For Sci, 2013

Total C stocks in different land uses - Results



Conti *et al.* (under review)

Total C stocks in different land uses - Results



Conti *et al.* (under review)

Changes in C stocks between land uses - Results

Land-use change transition	Absolute C change (Mg C ha^{-1}) with relative change between brackets				
	Aboveground plant standing biomass	Aboveground plant dead biomass	SOC_{0-30}	SIC_{0-200}	Total organic C_{0-30}
Primary forest to secondary forest	-6.8 (-20.4%)	-1.2 (-13%)	0.6 (+2.1%)	-12.3 (-20.3%)	-7.4 (-10.4%)
Primary forest to closed shrubland	-18.1 (-53.9%)	-6.2 (-70.3%)	-10.5 (-8.7%)	-10.7 (-6.2%)	-34.8 (-48.6)
Primary forest to open shrubland	-23.6 (-70.3%)	-7.3 (-82.4%)	-16.1 (-55.4%)	-11.8 (-19.4%)	-47 (-65.7%)
Primary forest to potatoe crop	-33.2 (-98.7%)	-8.8 (-100%)	-13.2 (-45.8%)	-27.63 (-45.4%)	-55.5 (-77.6%)
Secondary forest to closed shrubland	-11.2 (-42.1%)	-5.1 (-65.8%)	-11.1 (-37.3%)	1.7 (+3.4%)	-27.4 (-42.7%)
Secondary forest to open shrubland	-16.8 (-62.7%)	-6.1 (-79.8%)	-16.7 (-56.3%)	0.6 (+1.2%)	-39.6 (-61.8%)
Secondary forest to potatoe crop	-26.3 (-98.3%)	-7.7 (-100%)	-13.9 (-46.7%)	-15.2 (-31.6%)	-48.1 (-6.8%)
Closed shrubland to open shrubland	-5.5 (-35.6%)	-1.1 (-40.9%)	-5.6 (-30.4%)	-1.1 (-2.2%)	-12.2 (-33.3%)
Closed shrubland to potatoe crop	-15 (-97.2%)	-2.6 (-100%)	-2.8 (-15%)	-16.9 (-33.8%)	-20.7 (-56.4%)
Open shrubland to potatoe crop	-9.5 (-95.6%)	-1.5 (-100%)	2.9 (+22.1%)	-15.7 (-32.3%)	-8.5 (-34.6%)

Conti *et al.* (under review)

Remarking conclusions about land use effects on C stocks in the semiarid Chaco forest of Argentina

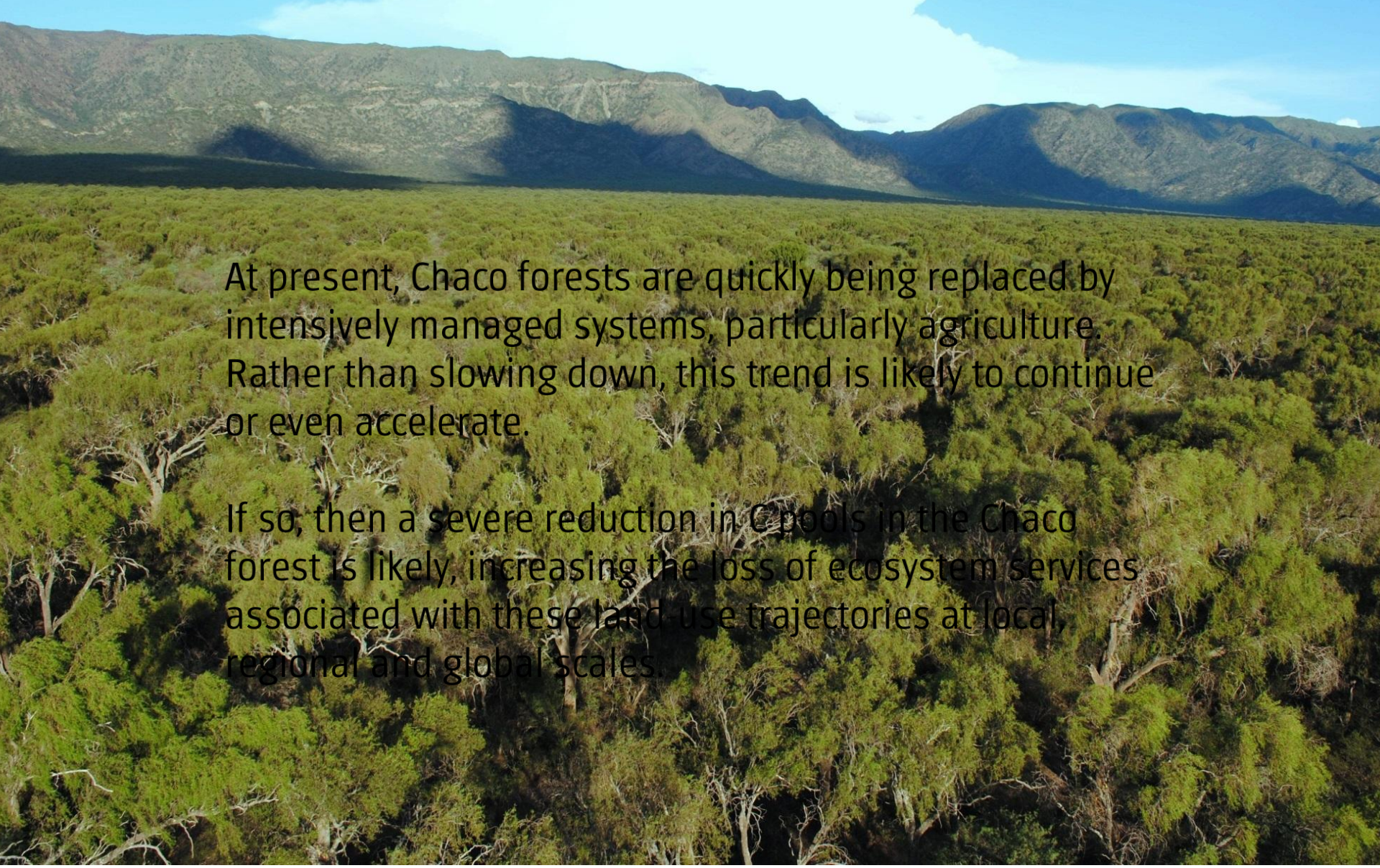
Total ecosystem C in the most conserved Chaco forest accounted for 179 Mg C ha^{-1}

Shrubs represented a significant proportion of the aboveground standing biomass (at least 28%) in all land uses (except cultivated ones).

C stored in organic soil represented the most important stock (≈ 40%) in all land-uses, and specifically the fraction under 30 cm depth.

Land-use not only alters the amount of C stored in biomass and in the organic fractions of the soil (SOC) but also in the inorganic C fraction.

Forest conversion to croplands and degraded shrublands reduces ≈70% the organic C stored in the ecosystem, with a relative reduction in surface SOC of 45%.



At present, Chaco forests are quickly being replaced by intensively managed systems, particularly agriculture. Rather than slowing down, this trend is likely to continue or even accelerate.

If so, then a severe reduction in C pools in the Chaco forest is likely, increasing the loss of ecosystem services associated with these land use trajectories at local, regional and global scales.

THANKS FOR YOUR ATTENTION!