N and P limitation shapes plant-AMF interactions across an aridity gradient

DFG Priority Program 1803
„EarthShape: Earth Surface Shaping by Biota“
Phase I 2016 - 2018

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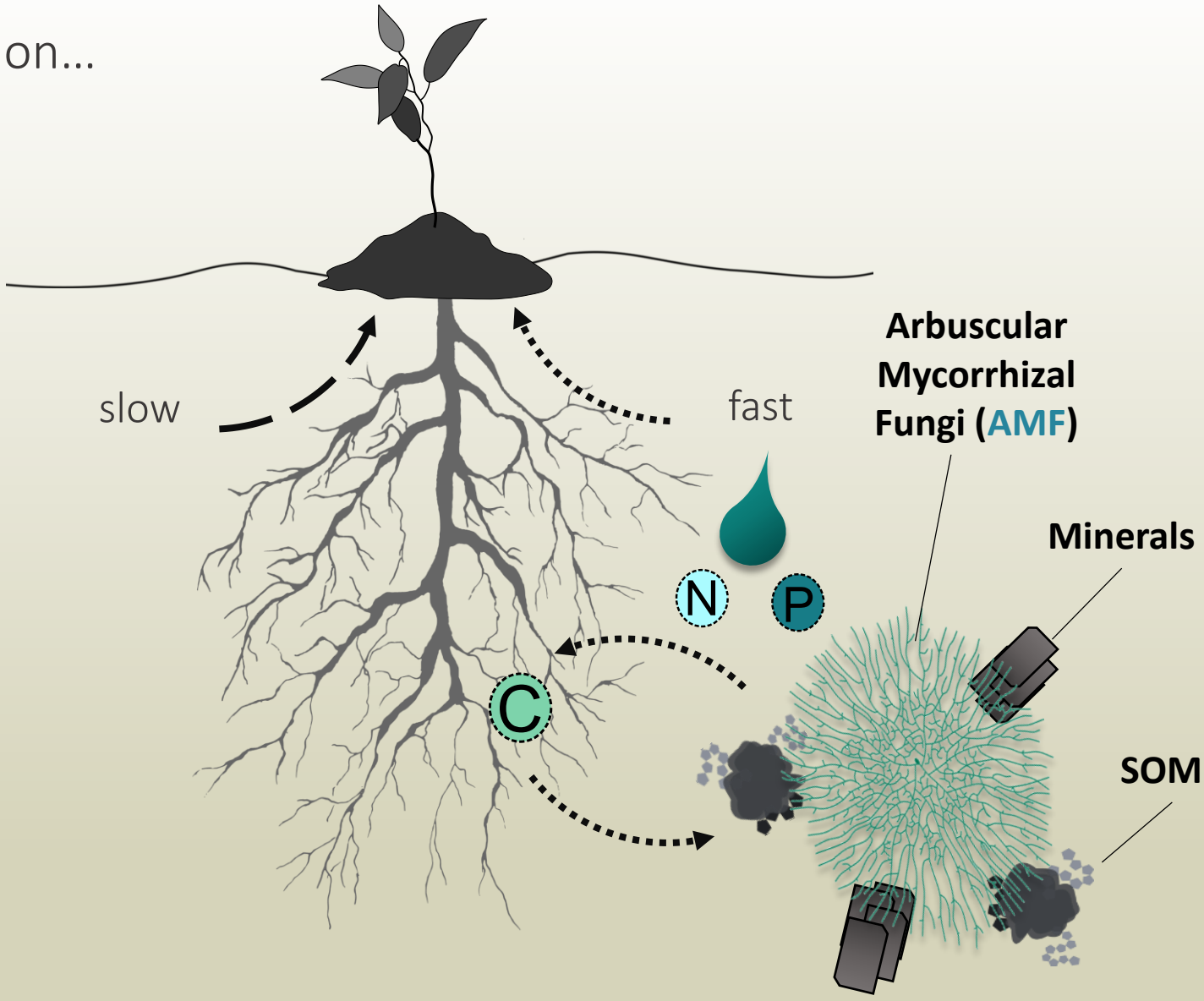
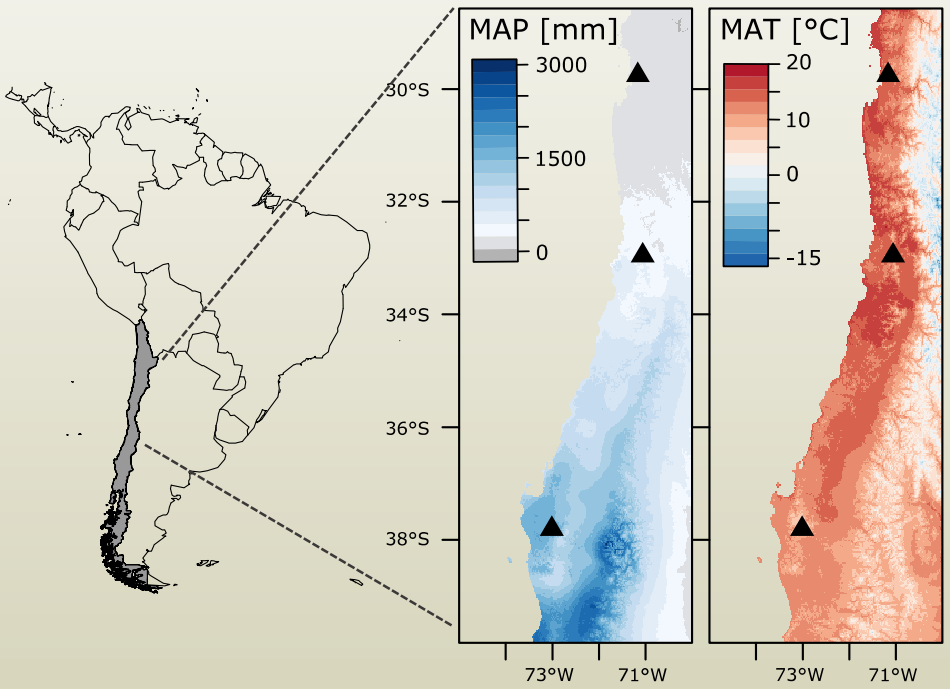
Plant nutrient acquisition…

AMF support plant nutrition and can alleviate drought stress

Does **importance** of **AMF** for plant nutrient acquisition increase with increasing **aridity**?



Study areas in the Chilean Coastal Cordillera



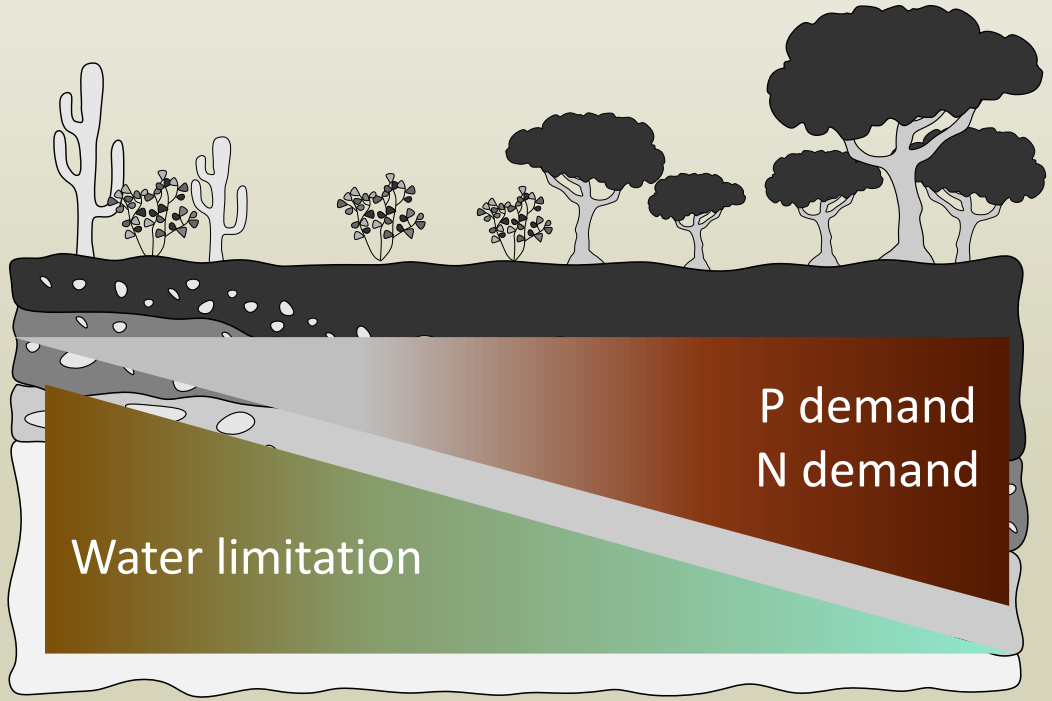
Maps of region of study area in Chile. (WorldClim2 data, Fick and Hijmans et al., 2017).

water-limited — nutrient-limited

< 100 mm a^{-1} precipitation ~1500 mm a^{-1}

North **South**

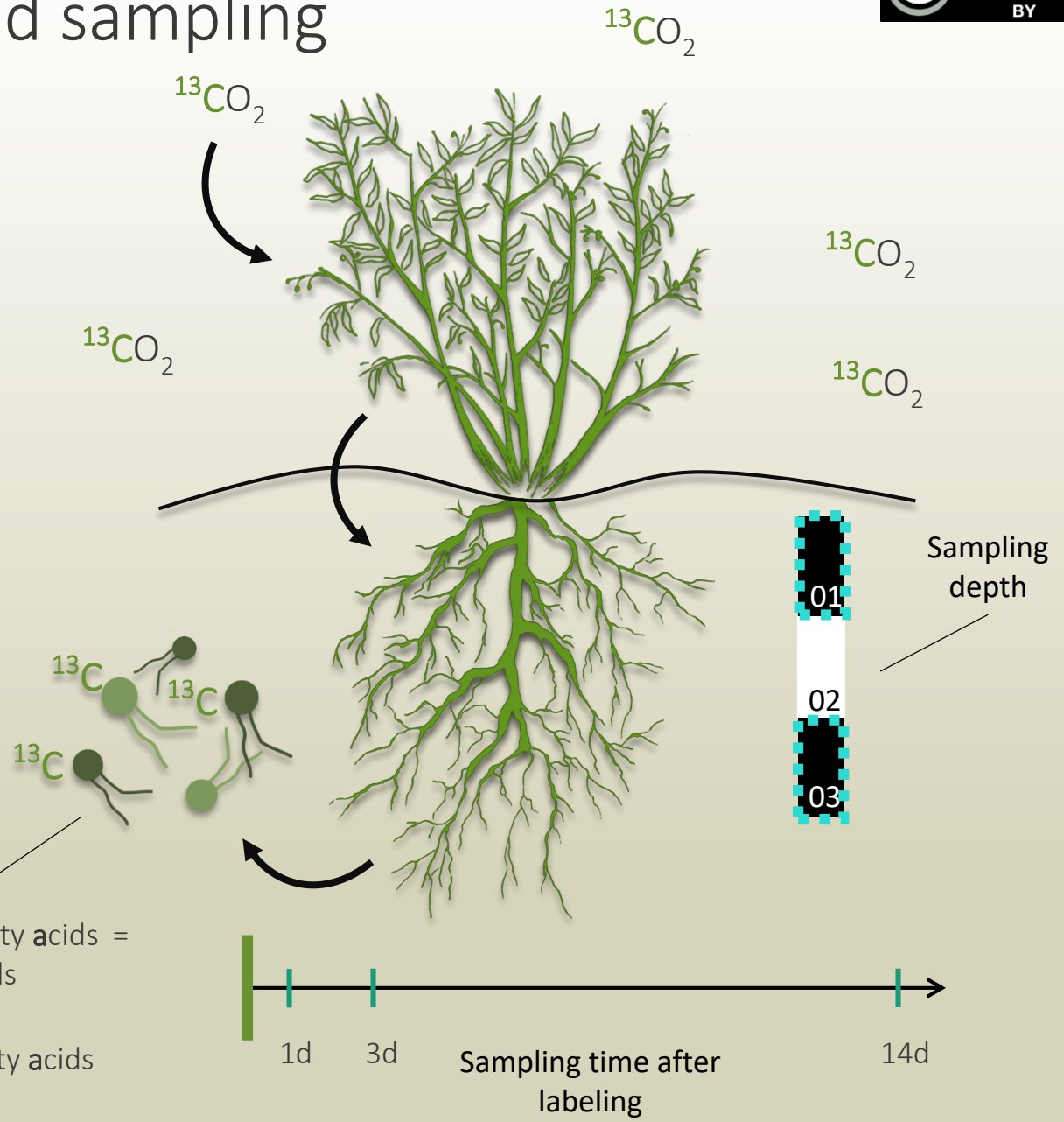
Shrubland Woodland Forest



Labeling and sampling

- $^{13}CO_2$ pulse labeling
- Chamber: 60 x 60 x 60 cm
- Tracer: 99 at% $Na_2{}^{13}CO_3$
- Vegetation: biome specific, woody, 40-60 cm height

→ Tracing C allocation to AMF and fine roots



Measurements

SOC

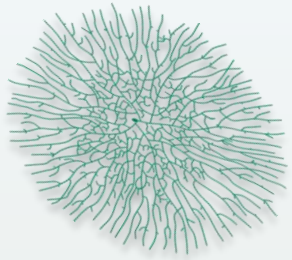
N_{tot}

P_{tot}

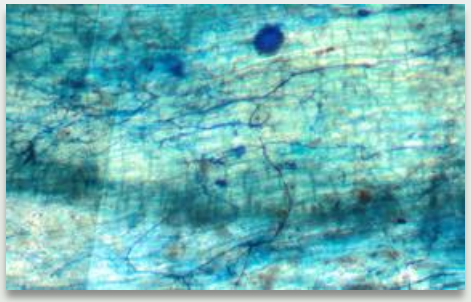
Soil moisture

Root Tissue Density (RTD)

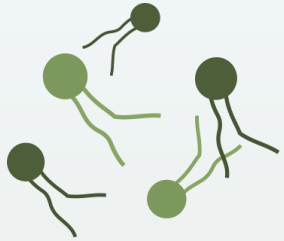
Specific Root Length (SRL)



% Root colonization with AMF



Root stained with ink-vinegar solution (Vierheilig et al., 1998)



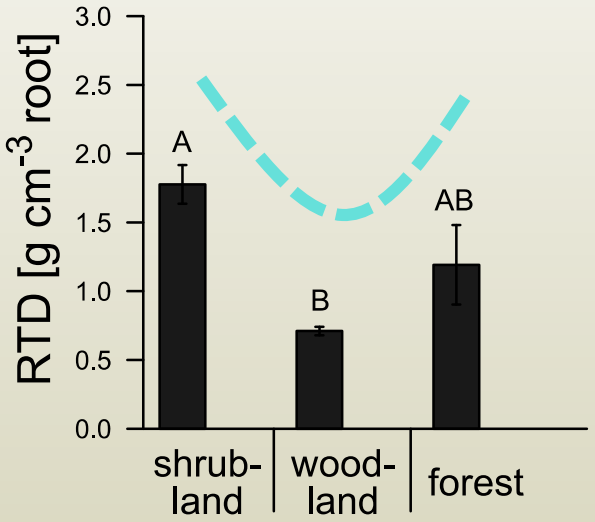
$16{:}1\omega5_{PLFA}$
= AMF marker

= proxy for extent of hyphal network in soil

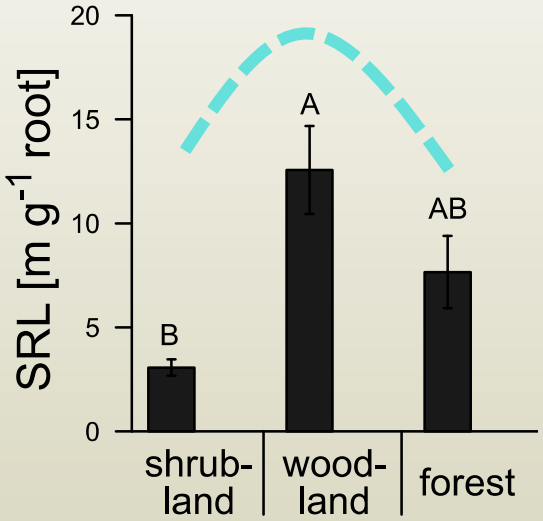
C allocation to AMF and root tissue

Potential of nutrient acquisition

Root Tissue Density



Specific Root Length



Resistance
Life-span

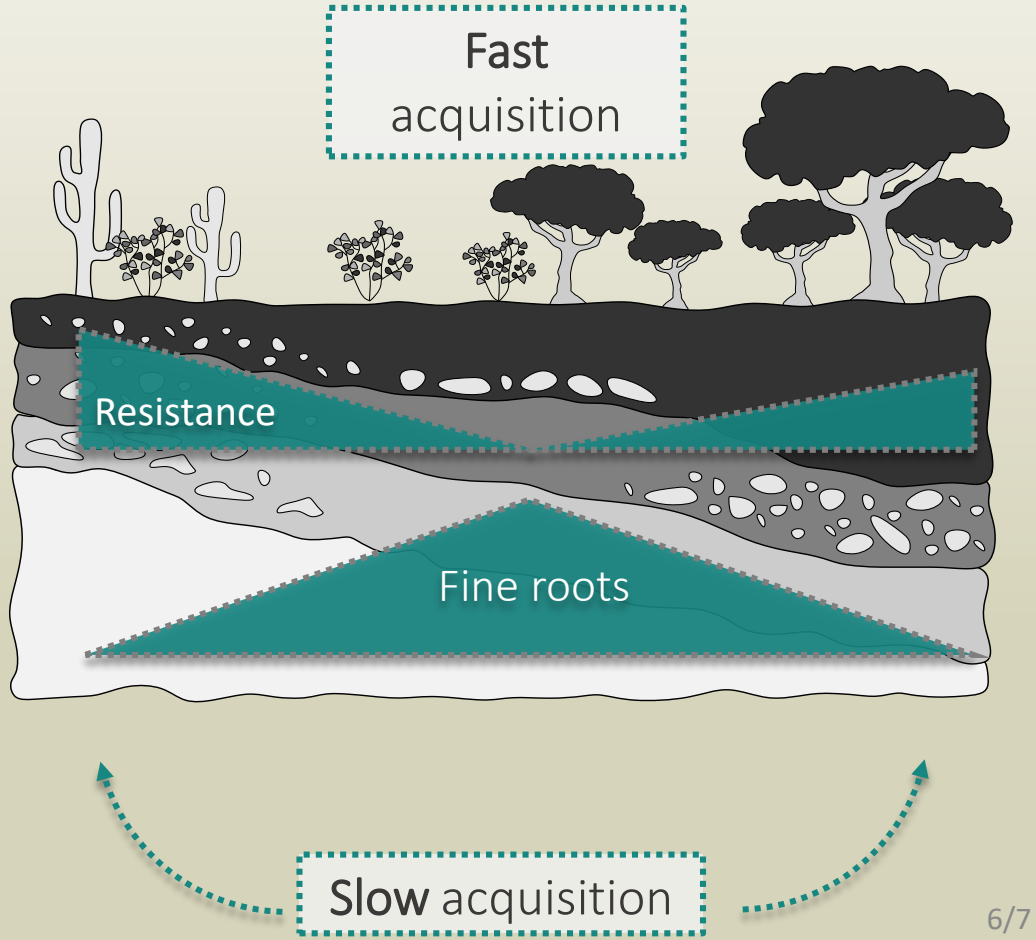
$$SRL\ [m\ g^{-1}] = \frac{fine\ root\ length}{dry\ root\ mass}$$

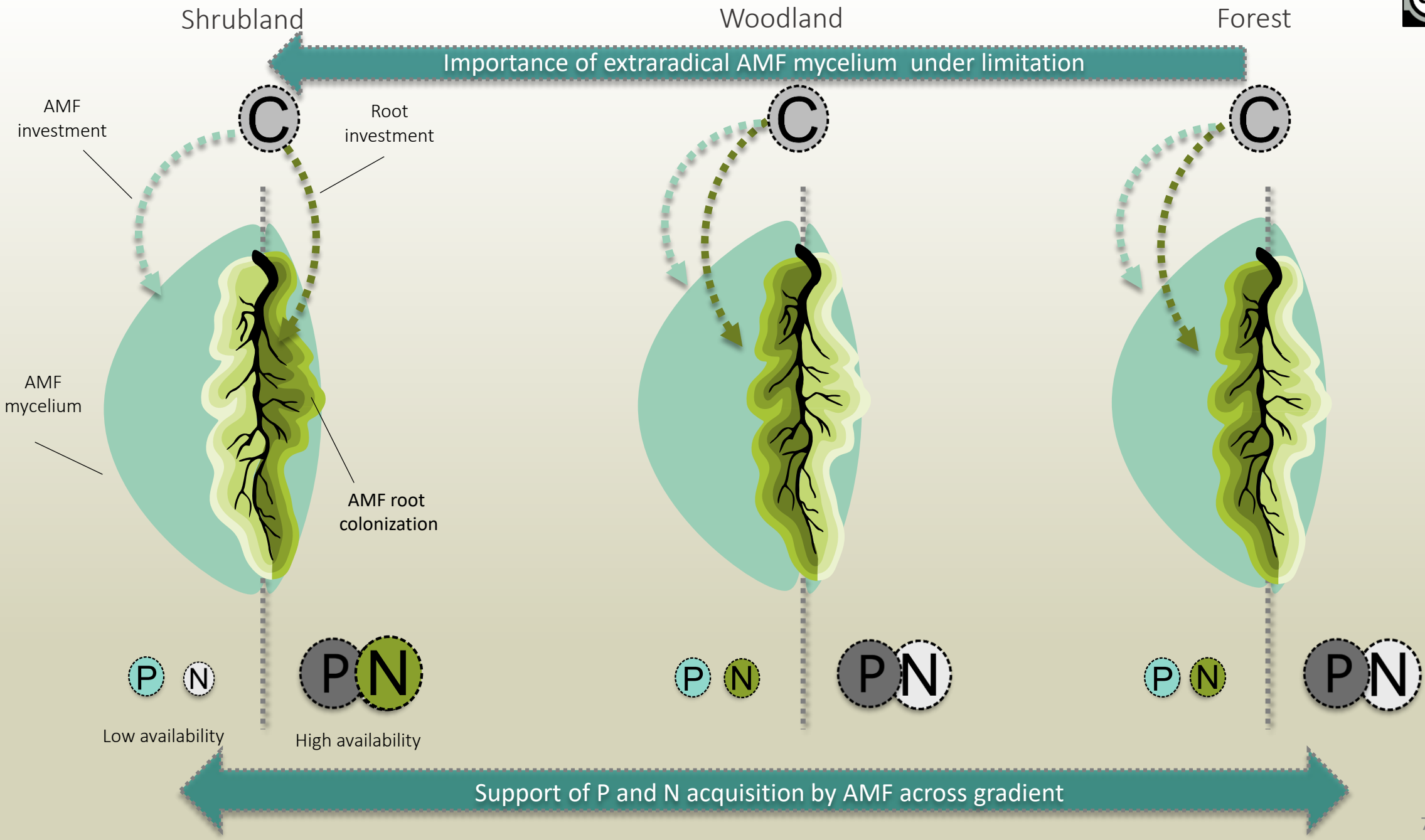
$$= \frac{\boldsymbol{benefit}}{\boldsymbol{cost}}$$

water-limited — nutrient-limited

< 100 mm a^{-1} precipitation ~1500 mm a^{-1}

North — South




Shrubland
Woodland
Forest
Importance of extraradical AMF mycelium under limitation
C
AMF investment
Root investment
AMF mycelium
AMF root colonization
P
N
Low availability
High availability
Support of P and N acquisition by AMF across gradient