



Forest loss and restoration – a case study of tropical montane forest

Roger Wilson, World Land Trust

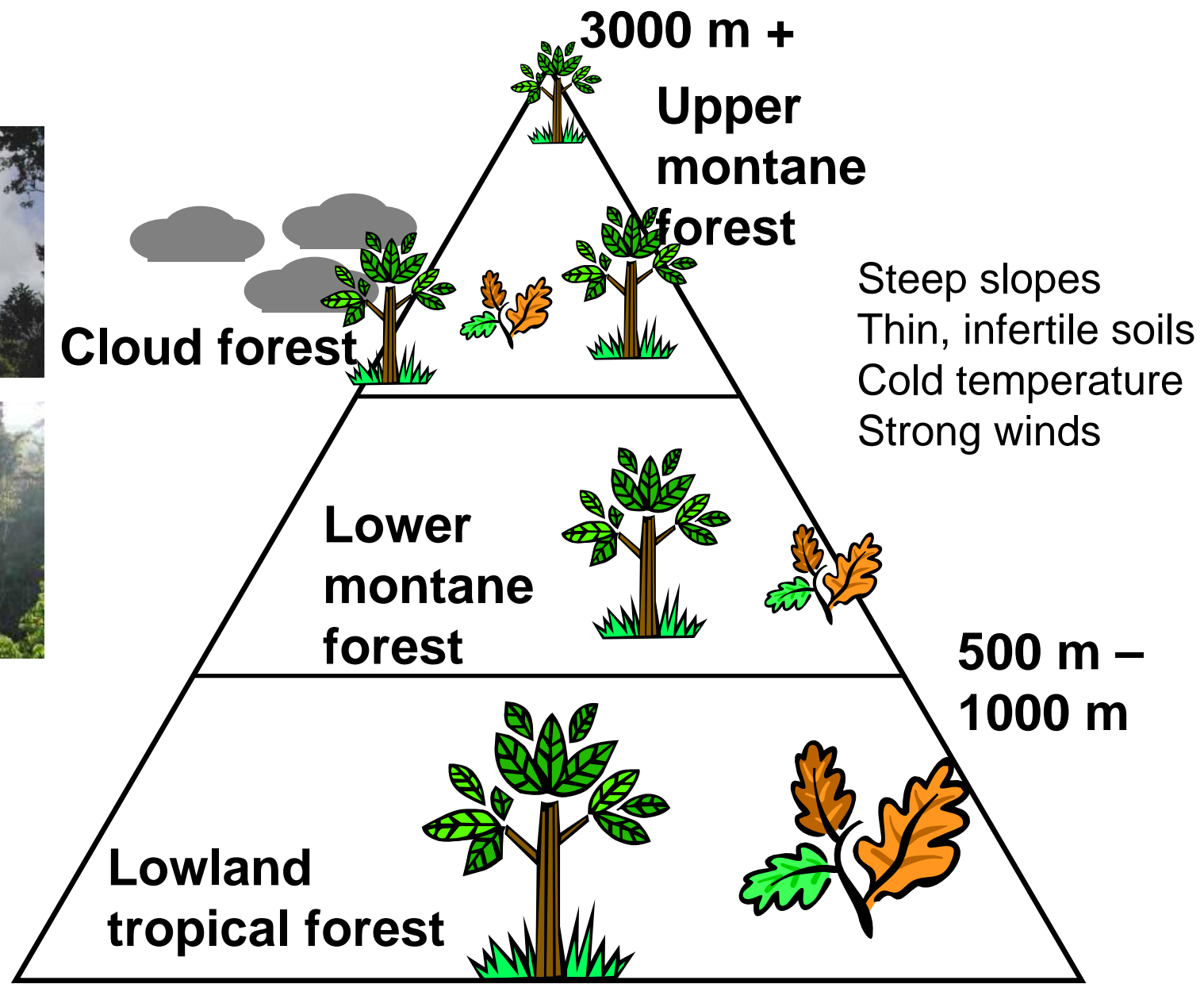
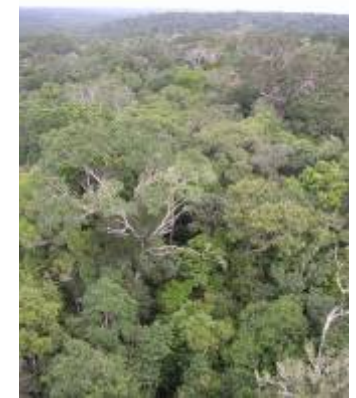
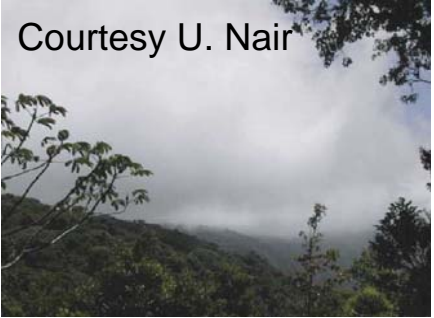
Dominick Spracklen, University of Leeds



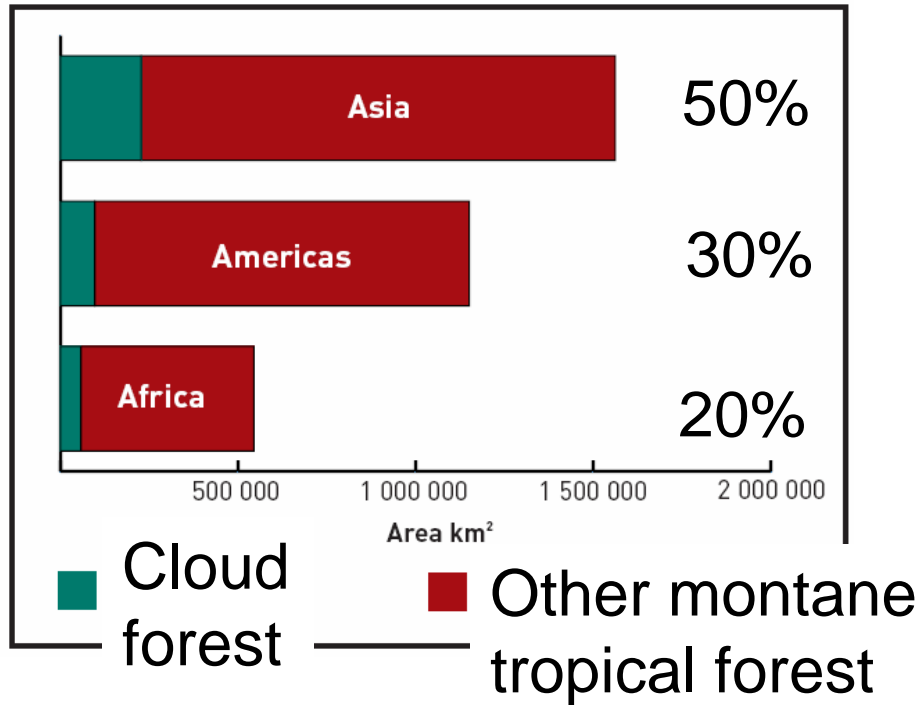
Talk Outline

- 1) Background and motivation
- 2) Carbon storage in tropical montane ecosystems
- 3) Linking carbon finance to tropical montane forest restoration

Tropical montane forests



Distribution



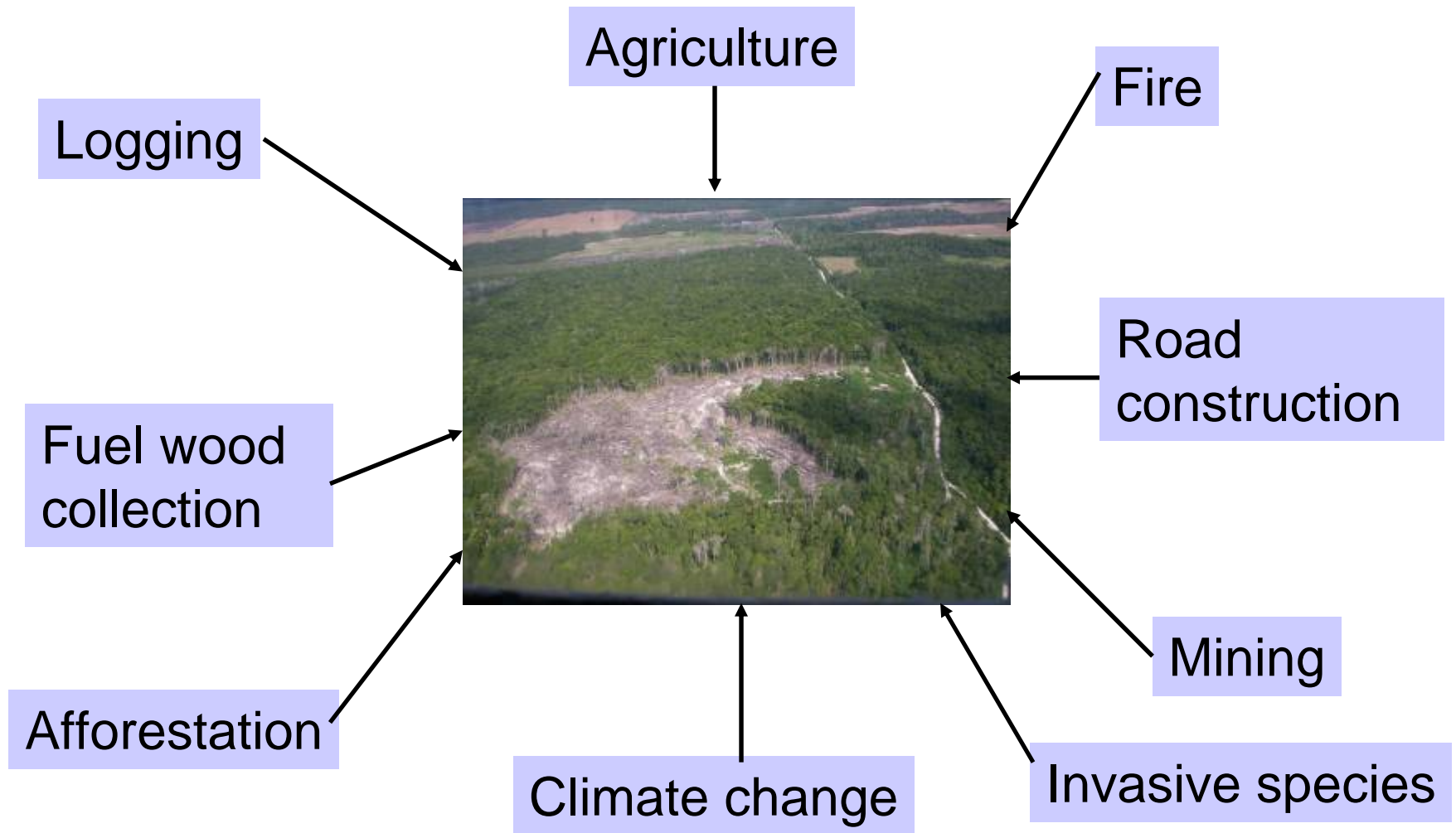
Montane forest in South America



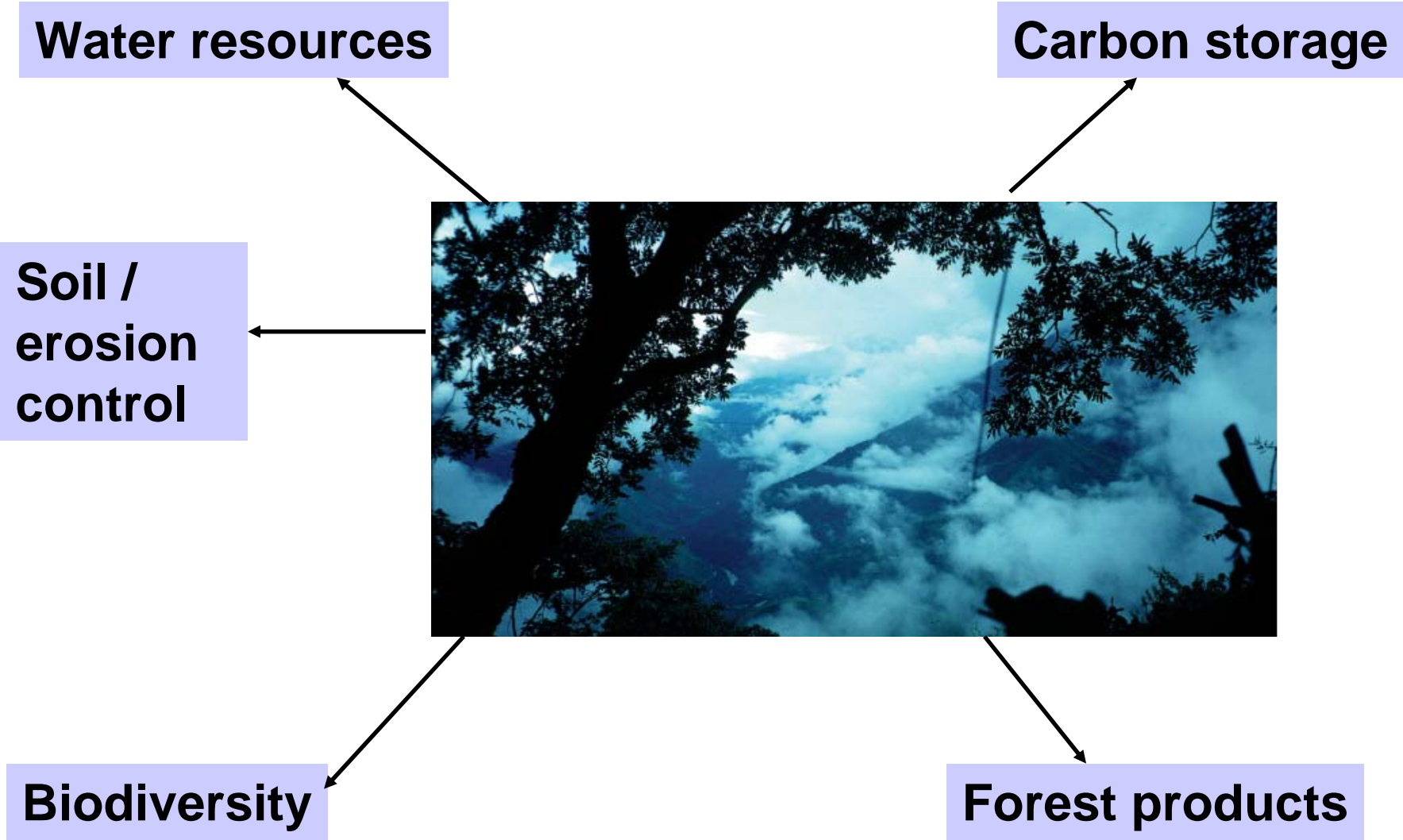
Bubb et al., UNEP

Tropical montane forests cover about 300 million hectares worldwide.

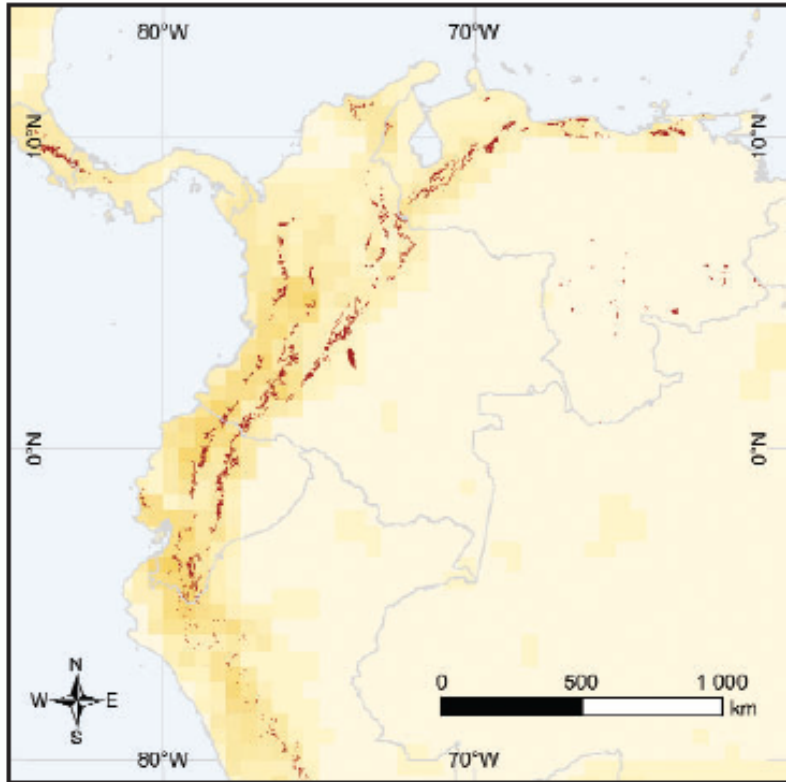
Threats to montane forests



Environmental services from montane forests



Biodiversity



Number of threatened species per 50 km²

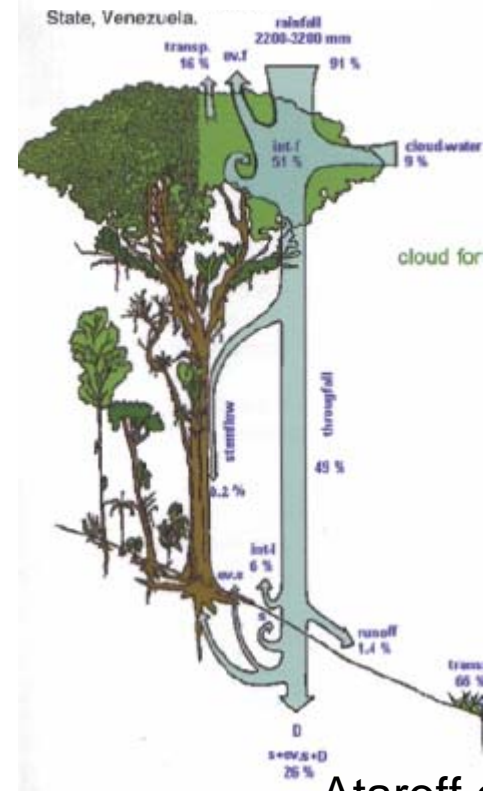


Potential cloud forest
[Birdlife International/UNEP]

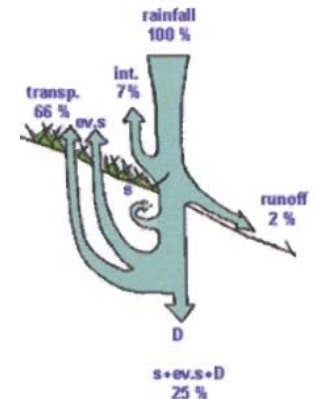
Water resources

Forest canopy intercepts mist and cloud increasing water input to forest catchment

Montane Forest



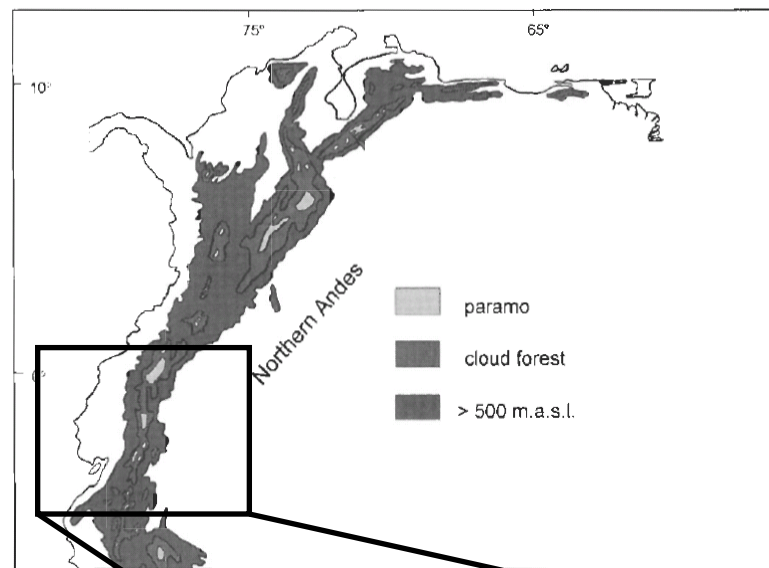
Pasture



Ataroff et al., 2000

Study areas – Buenaventura and Tapichalaca

- Relict tropical montane forest patches of very high conservation value
- Abandoned pasture reverting to secondary forest on livestock removal.



- **Buenaventura** - Pacific Slope foothill cloud forest, 700-1200 m asl.
- **Tapichalaca** - Upper Amazon drainage montane humid forest, 1800-2500m asl.

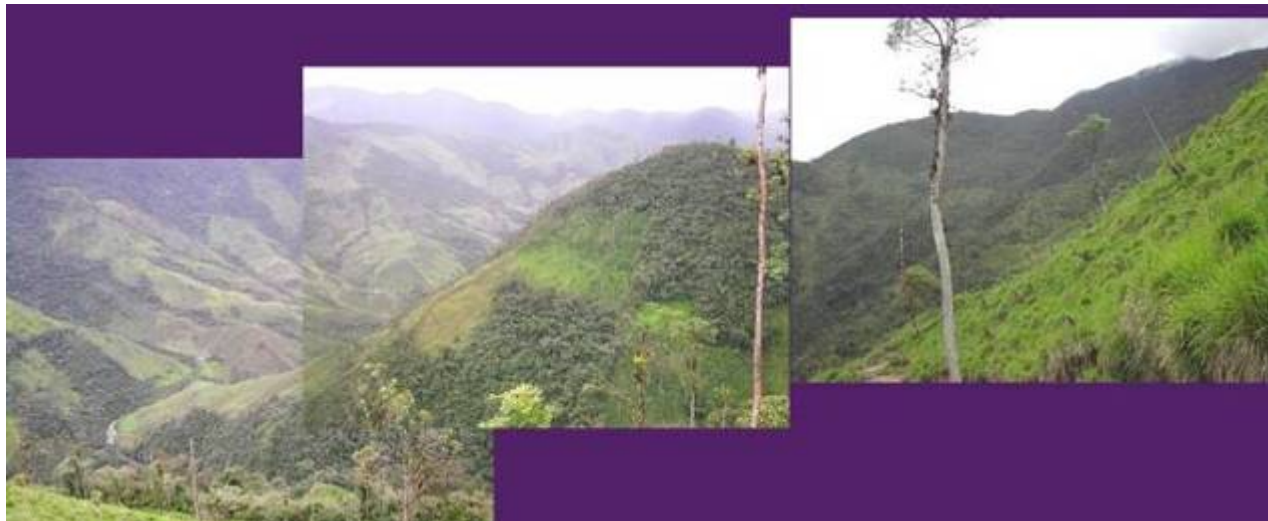


Aims:

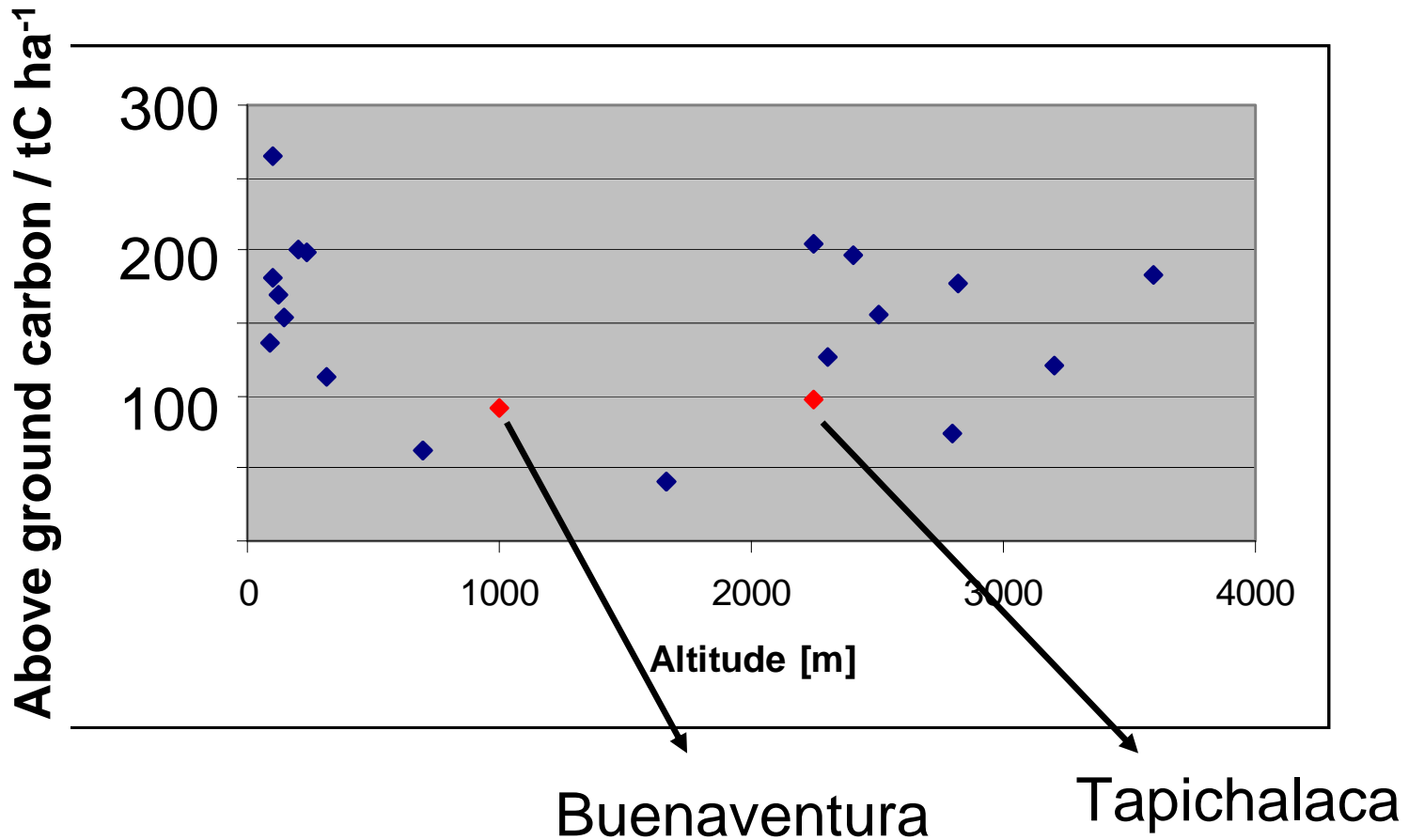
- Evaluate carbon storage in tropical montane forest
- Evaluate sequestration rates in naturally regenerating secondary forest and abandoned pasture

Methodology:

- Seven permanent 1 Ha plots along a chronosequence of forest regeneration including 2 mature 'primary' forest sites
- Quantified above ground carbon using measurements of DBH (DBH > 10 cm, 2.5 cm < DBH < 10 cm, dead wood, root biomass) and allometric equations using RAINFOR methodology



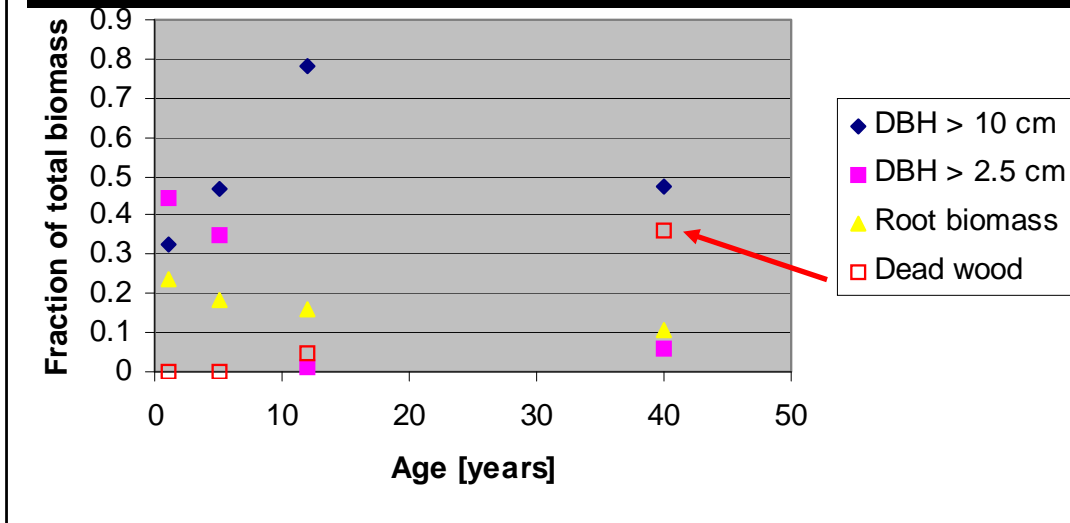
Carbon storage in tropical montane tropical forests



Montane forests typically store 100-200 tC / ha above ground and is relatively constant with altitude.

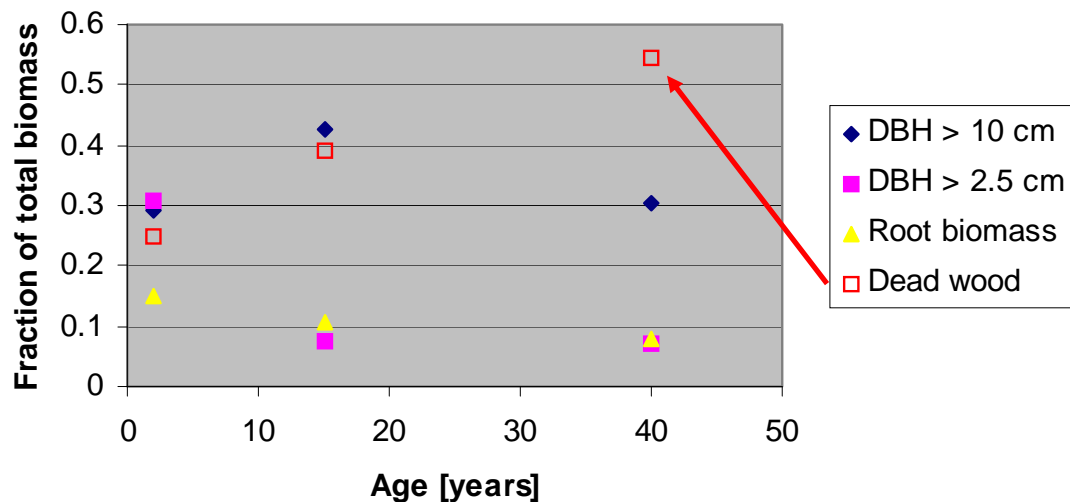
Carbon storage in tropical montane tropical forests

Buenaventura Reserve (1000 masl)

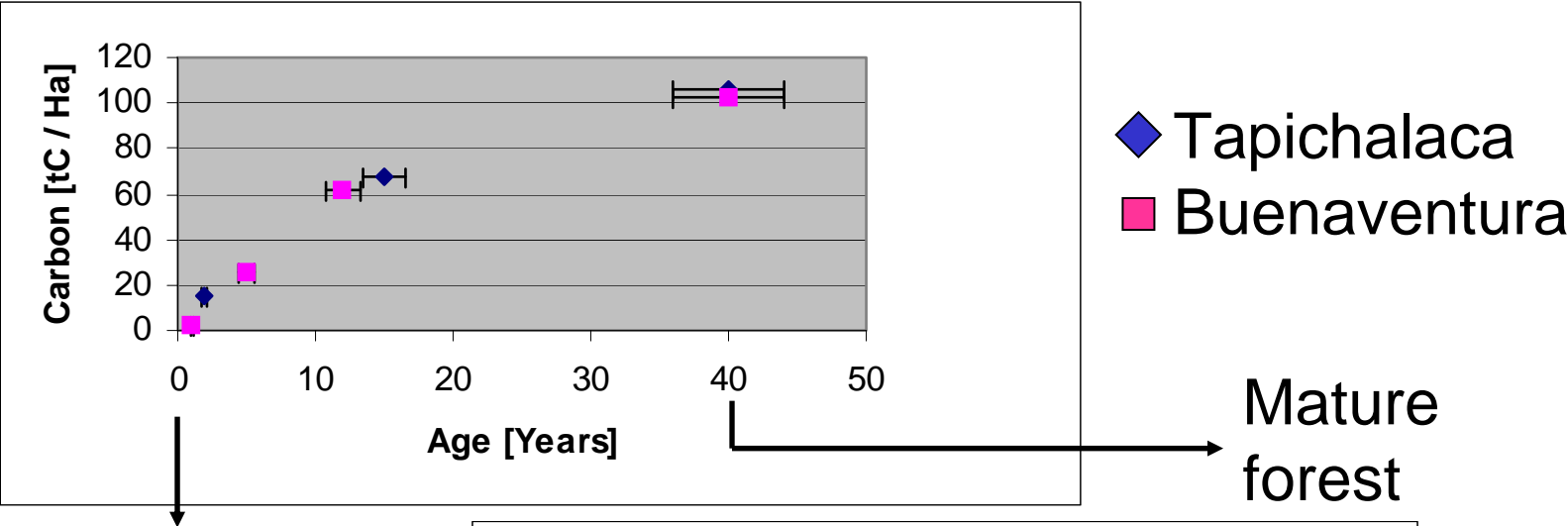


Dead wood contributes up to 50% of above ground carbon storage in tropical montane forests.

Tapichalaca Reserve (2200 masl)

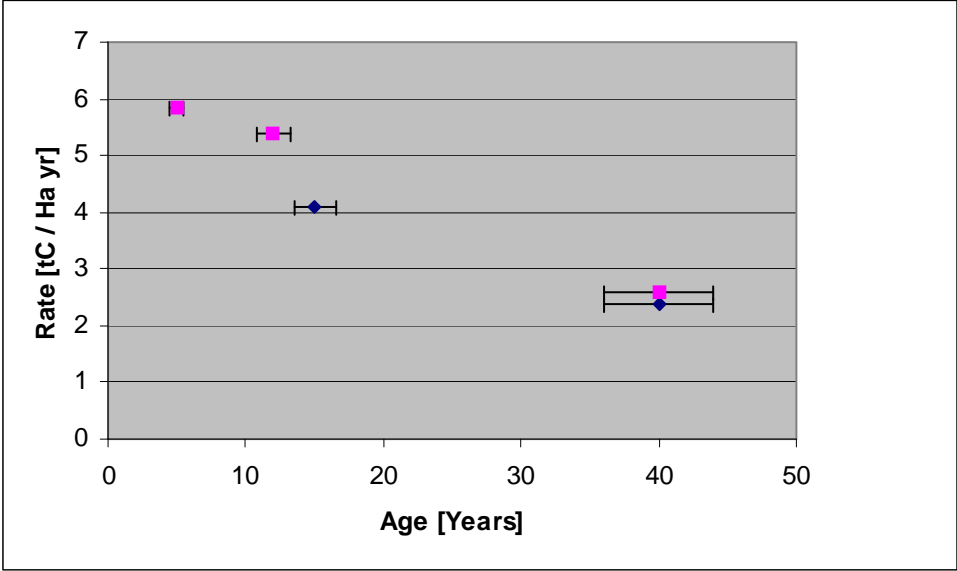


Carbon sequestration during forest restoration



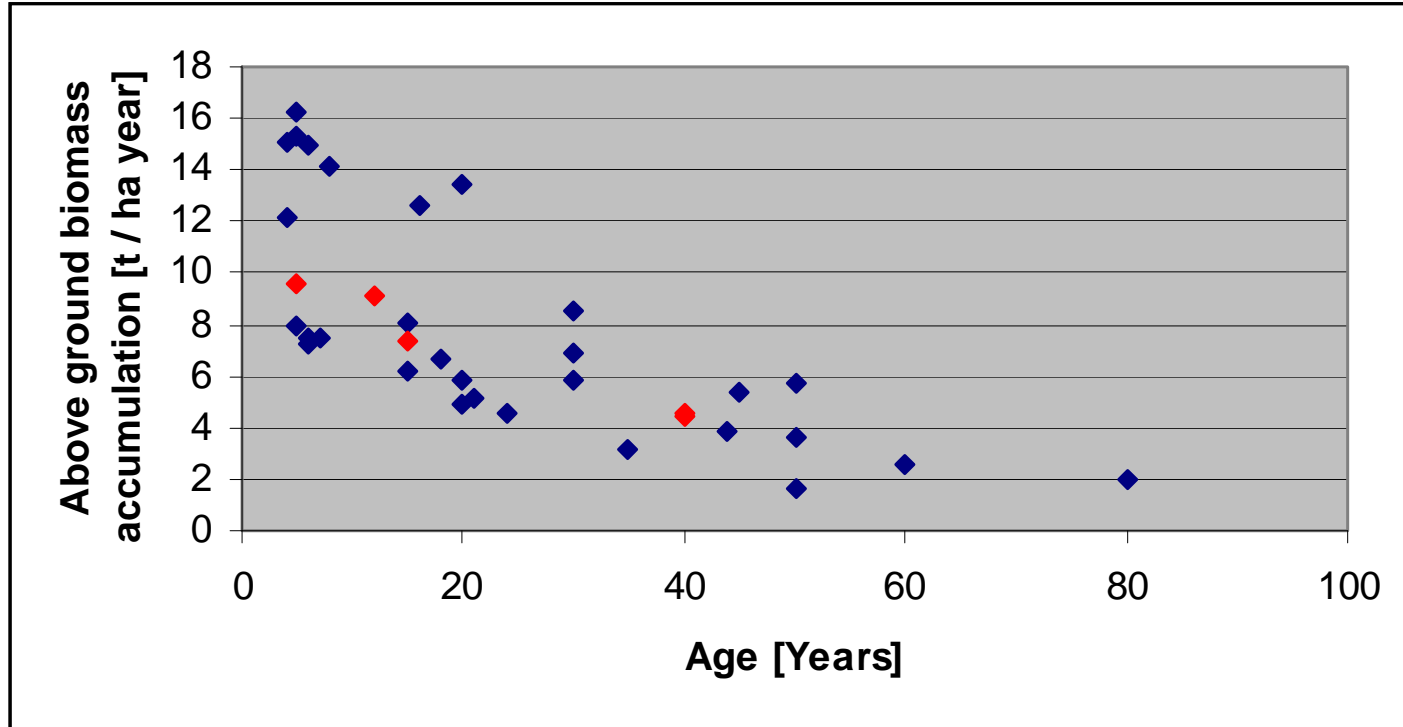
Abandoned
pasture

Mature
forest



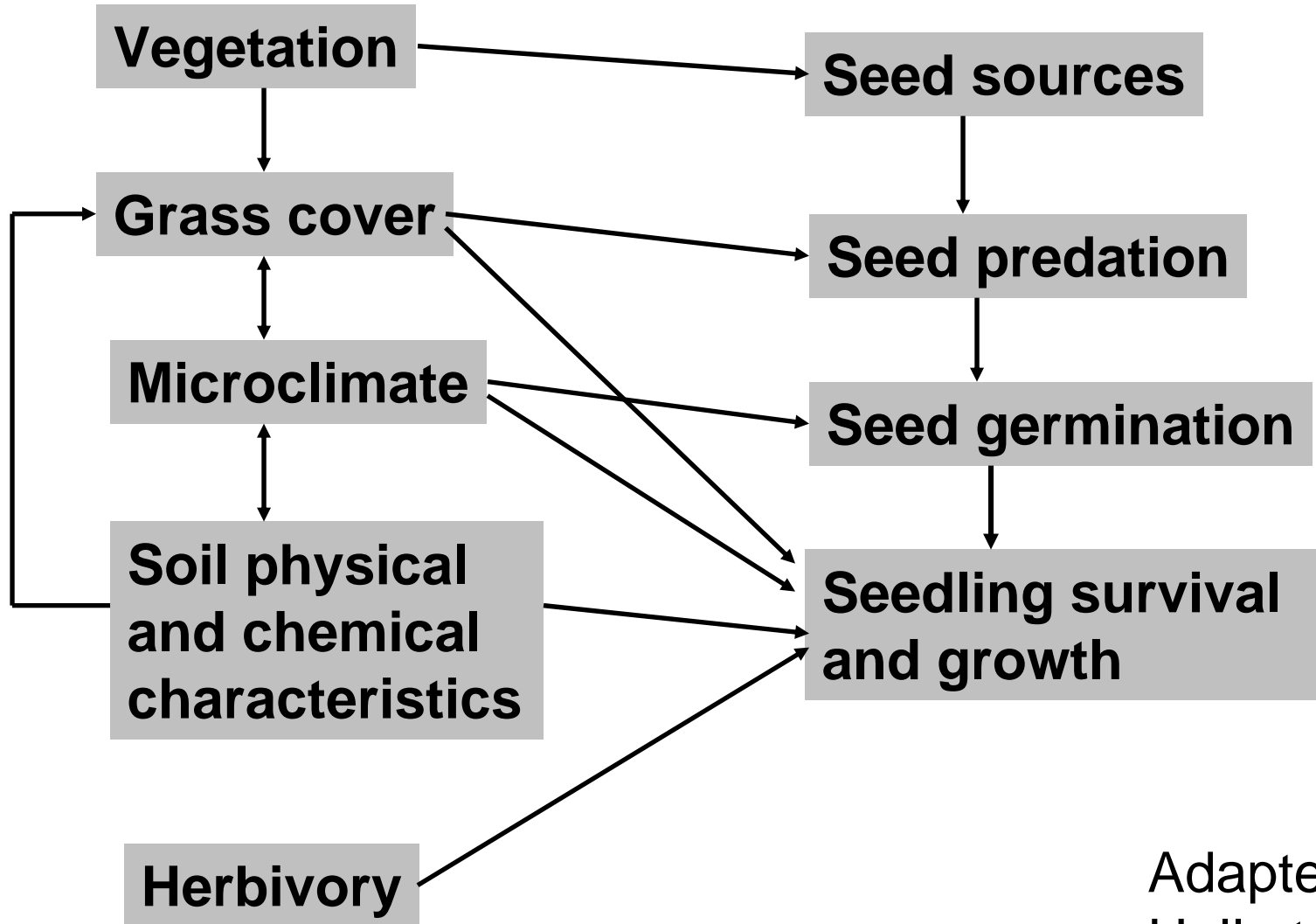
Carbon sequestration in recovering secondary forest is as high as 6 tC ha⁻¹ yr⁻¹

Carbon sequestration during forest restoration



Carbon sequestration in tropical montane sites matches rates observed elsewhere in the tropics

Barriers to forest regeneration



Adapted from
Holl et al., 2000

Using the results

- **Conclusions**

- Tropical montane cloud forests store 100-200 tC per hectare.
- Carbon sequestration of 6 tC ha⁻¹ yr⁻¹ in regenerating forest.
- Tropical montane forests are important and diminishing in area.

- **Can 'carbon finance' be used to restore and protect montane forests?**

- WLT pilot projects in partnership with Fundacion Jocotoco at Buenaventura, Tapichalaca, Yanacocha

WLT and Jocotoco – conservation of Ecuadorean montane forest

Strategy:

- **WLT mission** – to protect threatened forest of high biodiversity value in partnership with local organisations
- **Fundacion Jocotoco** – creation of a network of private reserves to complement and fill gaps in the national protected area system.

Leads to **WLT Carbon Balanced programme** – voluntary offsetting of CO₂ emissions through acquisition, reforestation and avoided deforestation of land contributing to Fundacion Jocotoco conservation aims.



Sequestration techniques (usually used in combination)

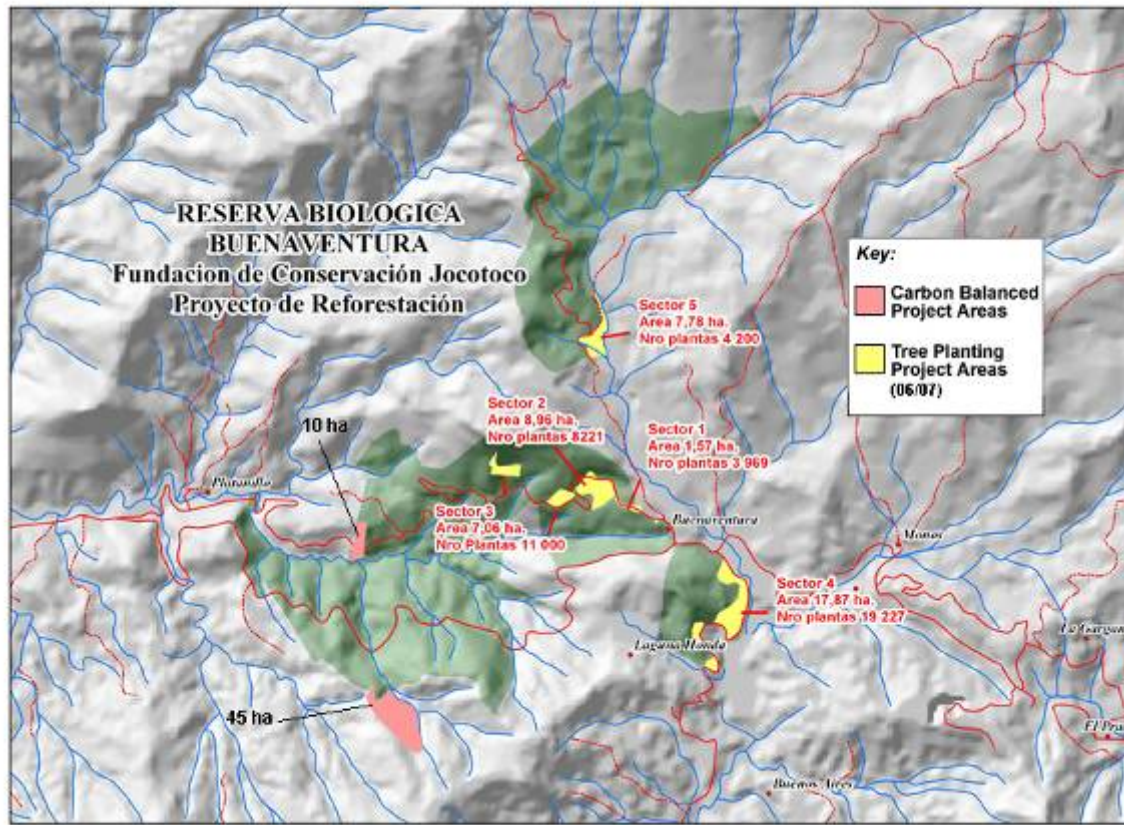
- Standing forest – protect, relieving threat;
- Degraded forest – protect, allow/enhance rehabilitation;
- Cleared land with good regeneration potential – Protect, relieve constraints (grazing, fire), enrich/enhance with liberation, planting, seeding;
- Cleared land with poor regeneration potential (e.g. bracken, invasive grass) – planting/cleaning.

Costs reduce from avoided deforestation to planting.

Buenaventura Reserve

Low altitude cloud forest, 500-1200m: threatened forest type; Birds

– 12 globally threatened species plus 33 of conservation concern.



- Reforestation at Buenaventura
- ‘Carbon Balanced’ are new land parcels;
- ‘Tree-planting’ uses same techniques to fill gaps in forest cover on existing parcels

Buenaventura

Programme of reforestation projects since 2004



Enrichment planting in natural regeneration – main valley sides



Reforestation – Carrion Property (120 ha p.a. – ongoing programme)



Tapichalaca

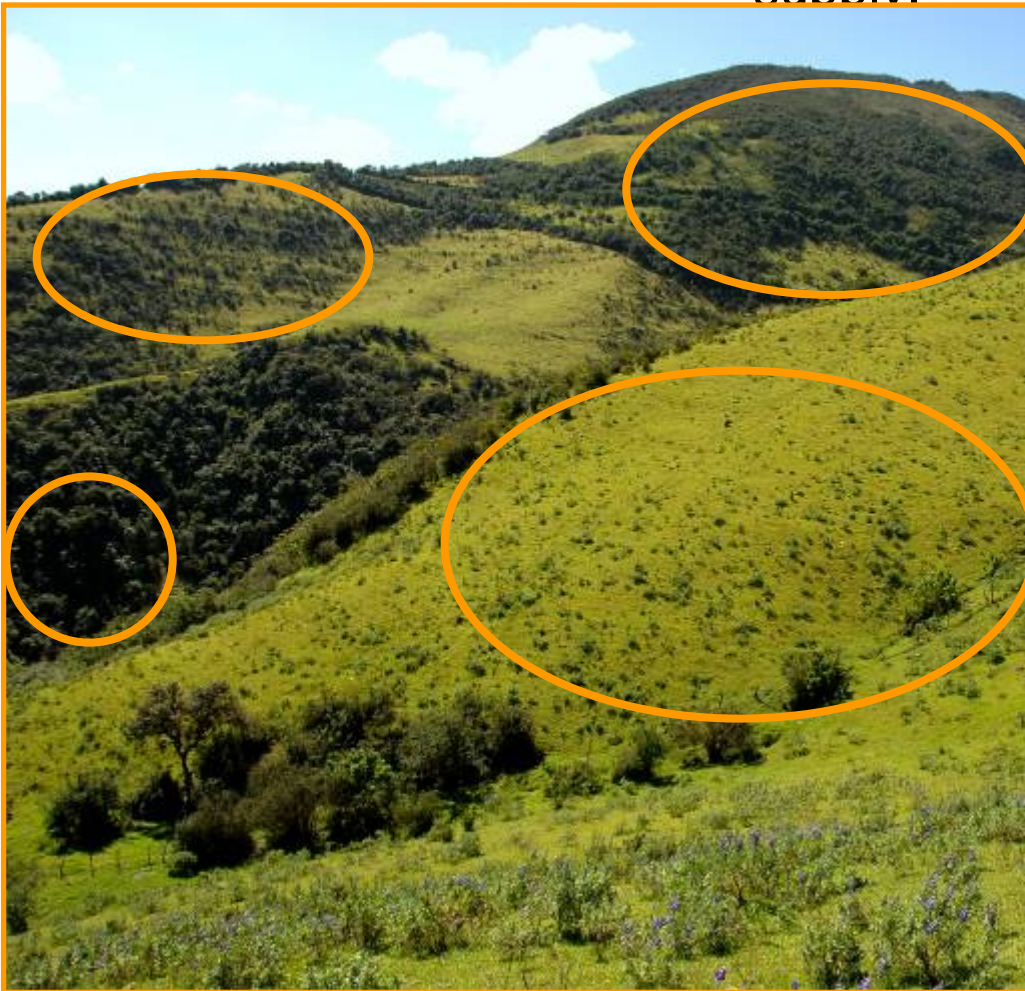
Montane forest 1800-2800 (-3500m) asl: Exceptional biodiversity;
Birds – 6 globally threatened species, 12 of conservation concern;
Plants – 25 endangered and 95 vulnerable endemic plants, 29
orchid spp only known from reserve.



- The Bustamante property – c. 1800 m asl
- Also enrichment planting on valley flanks, including Podocarpus.

Yanacocha

Montane/Polylepis forest, 3200 m asl: threatened forest type; Bird spp -1 critically endangered, 7 of conservation concern; Quito water supply.



La Campina (35 ha)

- Unthreatened forest – 7 ha
- Degraded forest – 16.5 ha (protect, regrow)
- Pasture – 11.5 ha (nat. regen., planting).

Gives:

- 11542 tCO₂ in 20 yrs
- equivalent to 9233 offsets (NB no leakage in this case);
- for US\$ 79,000.

Is it Practical?

- **Yes**, for voluntary actions especially in Corporate Social Responsibility area (i.e. carbon trading is not a prime consideration):
- **BUT** still needs to meet eligibility criteria – permanence, additionality, monitoring, independent verification – costly and only applicable in specific conditions. Furthermore, sites with high biodiversity value are not necessarily cheapest.
- **SO:**
 - Works best with programmes delivering >15,000 units p.a. Brings costs into the £5-10/tCO₂ range
 - From there, the larger the better for cost efficiency.

This is the direction we are now following: new projects are in the 50,000 unit p.a. range, same techniques expanded in scale bringing costs down to <£5.